



Fish Creek

Site Specific Analysis

Craig District Office
Bureau of Land Management
Craig, Colorado

November, 1982

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1. Introduction

This tract is located in Routt County, Colorado. The tract lies seven miles northwest of Oak Creek, Colorado (Map 1) in T. 4 N., R. 86 W., T. 5 N., R. 87 W., and T. 4 N., R. 87 W.

The site specific analysis is an assessment of the impacts to the environment based on assumptions of how the coal, in a specific tract, would be developed. The assumptions used for analysis for this tract are found in the Fish Creek Tract Profile Report (Bureau, 1982). See Map 2 for disturbed areas on tract.

1.1 Alternatives

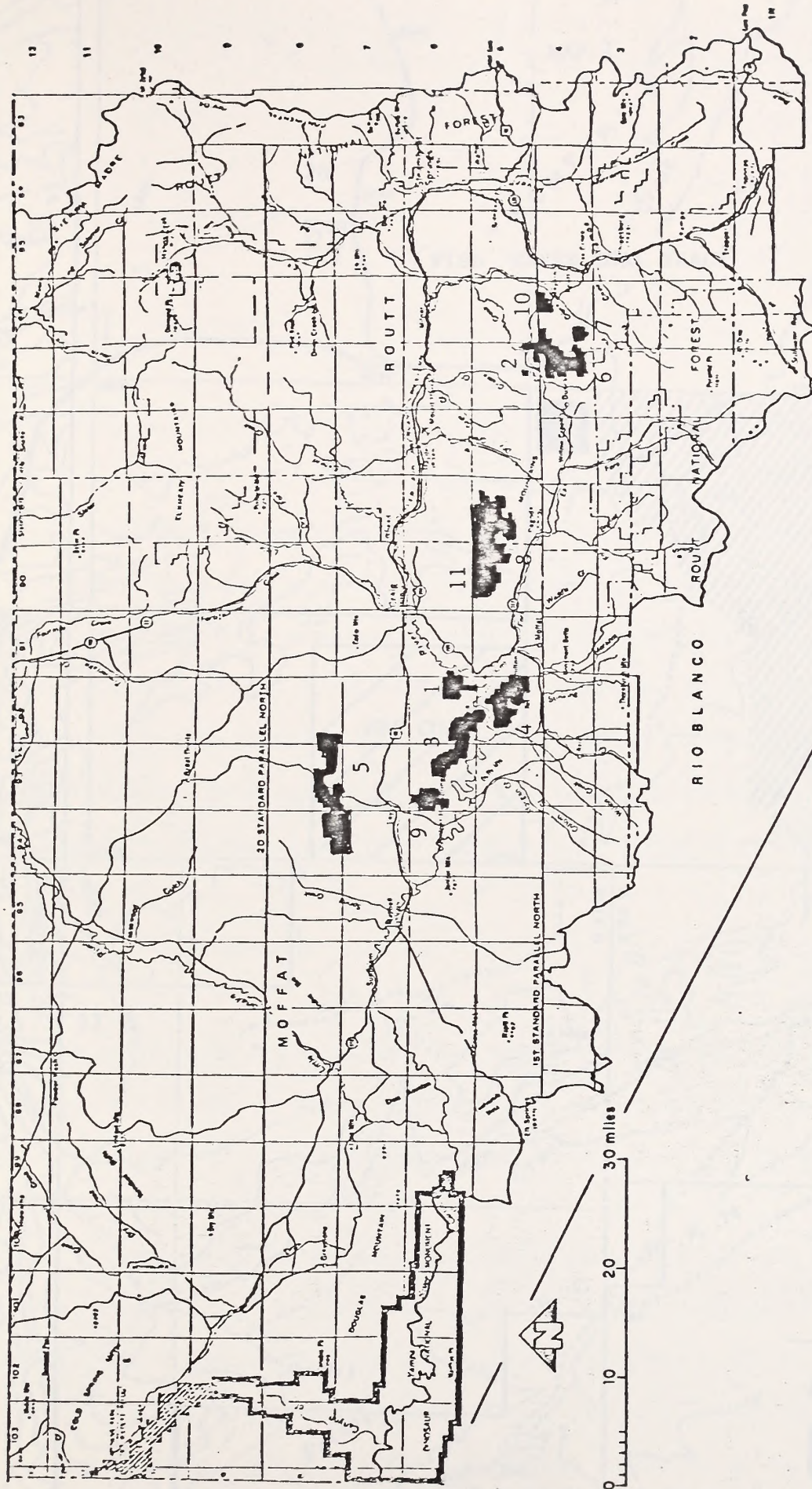
This site specific analysis assesses the impacts of two scenarios of the development alternative. Scenario 1 assumes Colorado Yampa Coal, with their existing surface mine and an existing proposed underground mine, would acquire the tract. Scenario 2 assumes a new operator would acquire the tract and develop it separately from the adjoining mine as a surface and underground mine. A discussion of these scenarios of the Development Alternative and the No Action Alternative may be found in the Fish Creek Tract Profile Report (Bureau, 1982).

2. Climate and Air Quality

Not available.

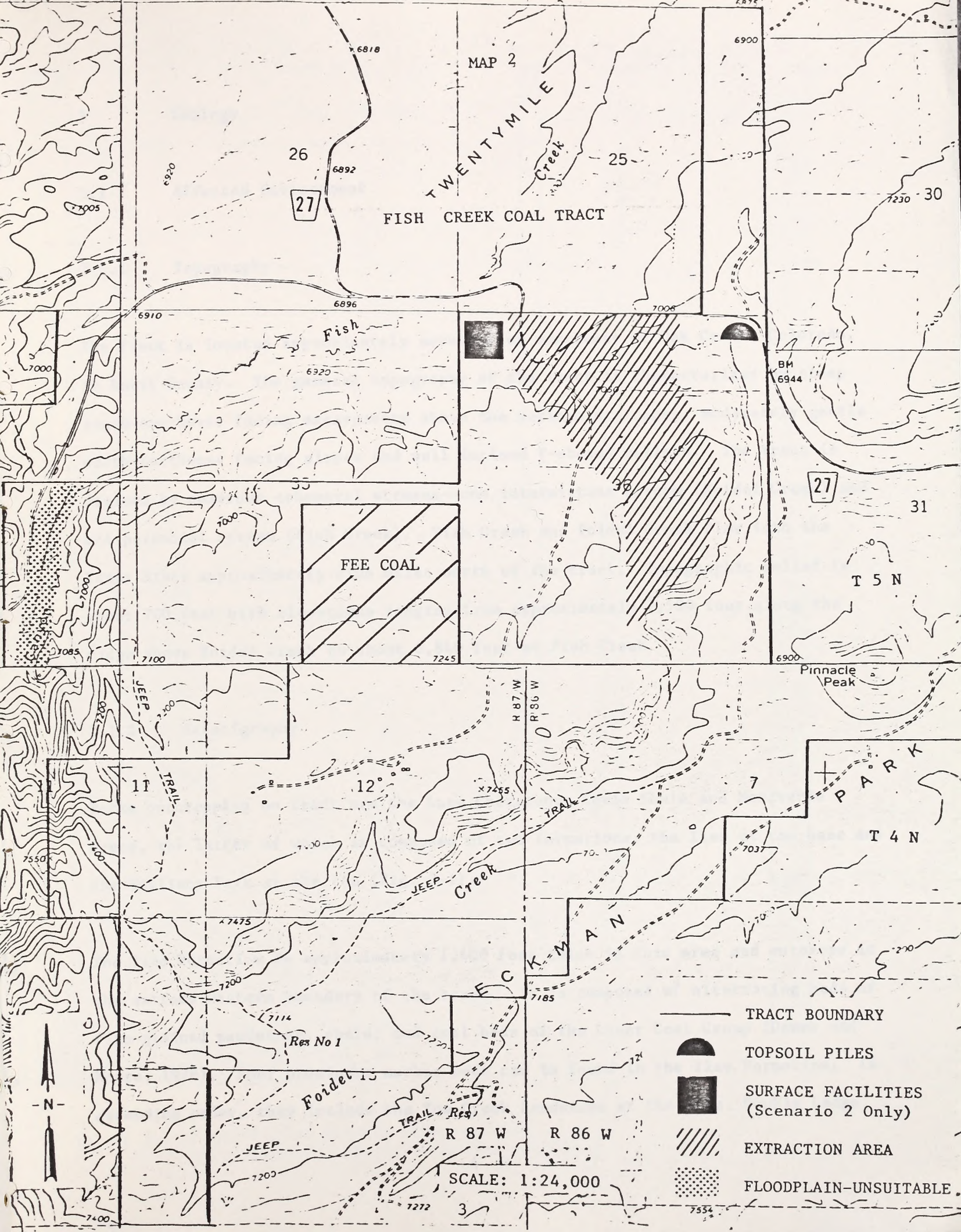
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MAP 1



- | | |
|------------------|-------------------|
| 1. BELL ROCK | 7. MIDDLE CREEK |
| 2. FISH CREEK | 8. PECK GULCH |
| 3. HORSE GULCH | 9. SIGNAL BUTTE |
| 4. ILES MTN. | 10. TROUT CREEK |
| 5. LAY CREEK | 11. WILLIAMS FORK |
| 6. L. MIDDLE CR. | |

COLORADO



3 Geology

3.1 Affected Environment

3.1.1 Topography

The tract is located approximately seven miles northwest of Oak Creek, Colorado, in Routt County. The general topography of the tract is characterized by steep south-southwest facing excarpments above the various drainages, moderately gentle north-northwest facing slopes and well incised V-shaped valleys. The tract is drained by numerous ephemeral streams--one intermittent stream (Foidel Creek) and one perennial stream (Fish Creek). Fish Creek and Foidel Creek flow into the Yampa River approximately nine miles north of the tract. Topographic relief is about 700 feet with elevations ranging from approximately 7,500 feet along the ridge above Foidel Creek to about 6,840 feet at Fish Creek.

3.1.2 Stratigraphy

Rocks outcropping on tract are the Late Cretaceous Lewis Shale and Mesaverde Group, the latter of which is composed of two formations, the Iles at the base and the Williams Fork at the top (Fig. 3-1).

The Iles Formation is approximately 1,400 feet thick in this area and outcrops in the extreme western boundary of the track. It is composed of alternating beds of fine-grained sandstone, shale, and coal beds of the Lower Coal Group (Dames and Moore, 1978). Four prominent marker beds can be found in the Iles Formation. In ascending order, they include the Tow Creek Sandstone at the base, Double Ledge

Sandstone, Oak Creek Sandstone, and the Trout Creek Sandstone at the top (BLM, et al, 1976).

The Williams Fork Formation lies conformably upon the Trout Creek Sandstone. The formation is approximately 1,300 feet thick in this area and is composed of alternating beds of fine-grained sandstone, siltstone, silty shale, marine shale, and coal beds of the Middle and Upper Coal Groups. The Williams Fork Formation is divided into the following members: a lower coal-bearing member (330 feet thick), a marine shale member (660 feet thick), the Twentymile Sandstone member (115 feet thick), and an upper coal-bearing member (200 feet thick). The lower and upper coal-bearing members correspond to the Middle and Upper Coal Groups respectively.

The Lewis Shale outcrops in the northwestern portion of the tract, and conformably overlies the Williams Fork Formation. It consists of dark gray marine shale interbedded with a few sandstone units (Hancock, 1925) and is about 1,900 feet thick (BLM, et al, 1976).

3.1.3 Structure

The tract is regionally located in the southern extension of the Sand Wash Structural Basin (Fig. 3-2.1). The basin is bordered on the east by the Park Range and on the southwest by the Axial Basin Anticline. The basin is highly modified by local anticlines, synclines, and faults.

Locally, the tract lies between the Fish Creek Anticline to the west and the Twentymile Park Syncline to the east (Fig. 3-2.2). Both structures basically trend north-south. Dips on tract average six degrees to the northwest, conforming to the broad nature of the respective structures.

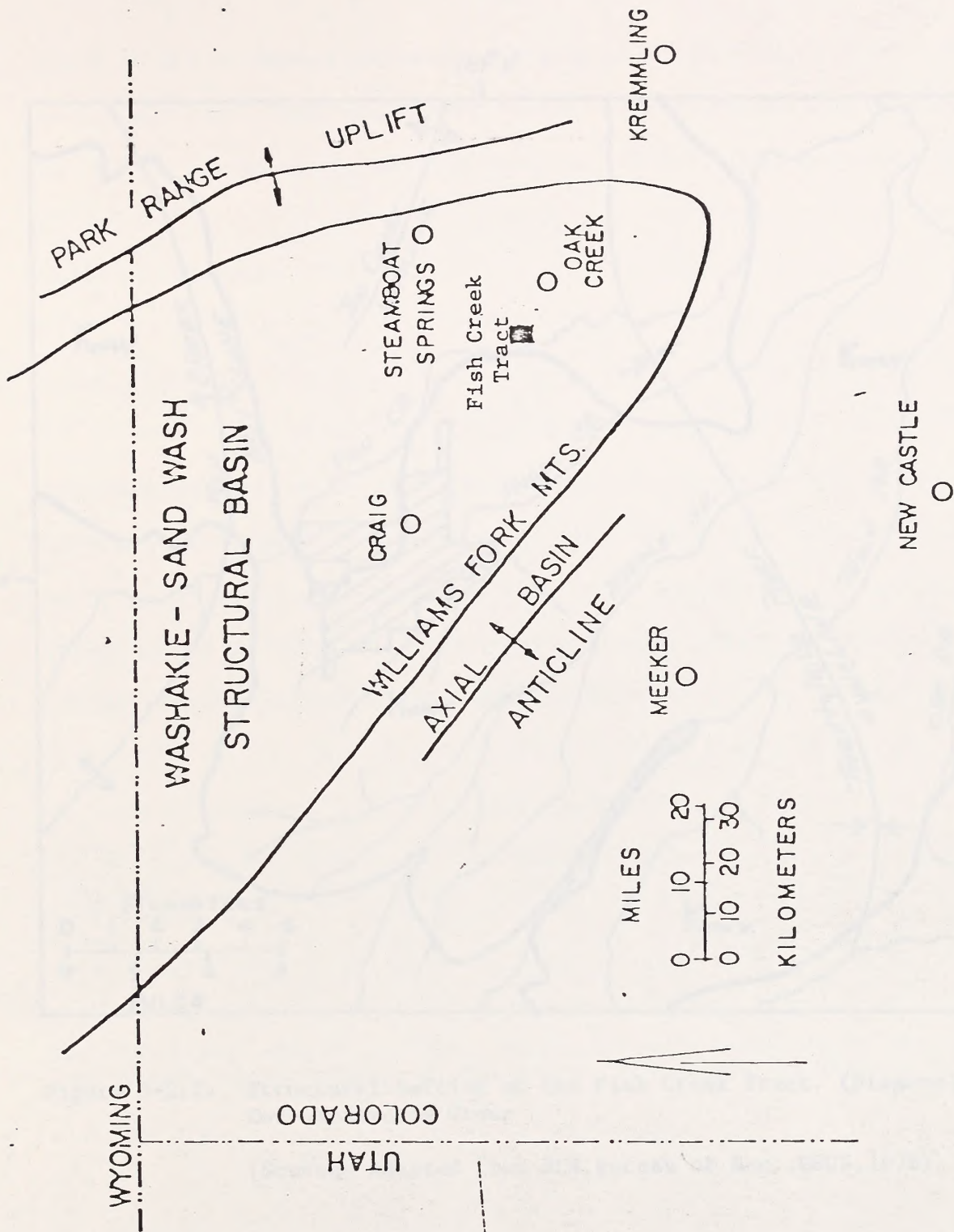


Figure 3-2.1 Generalized Structural Setting
(Energy Fuels Corp., 1979.)

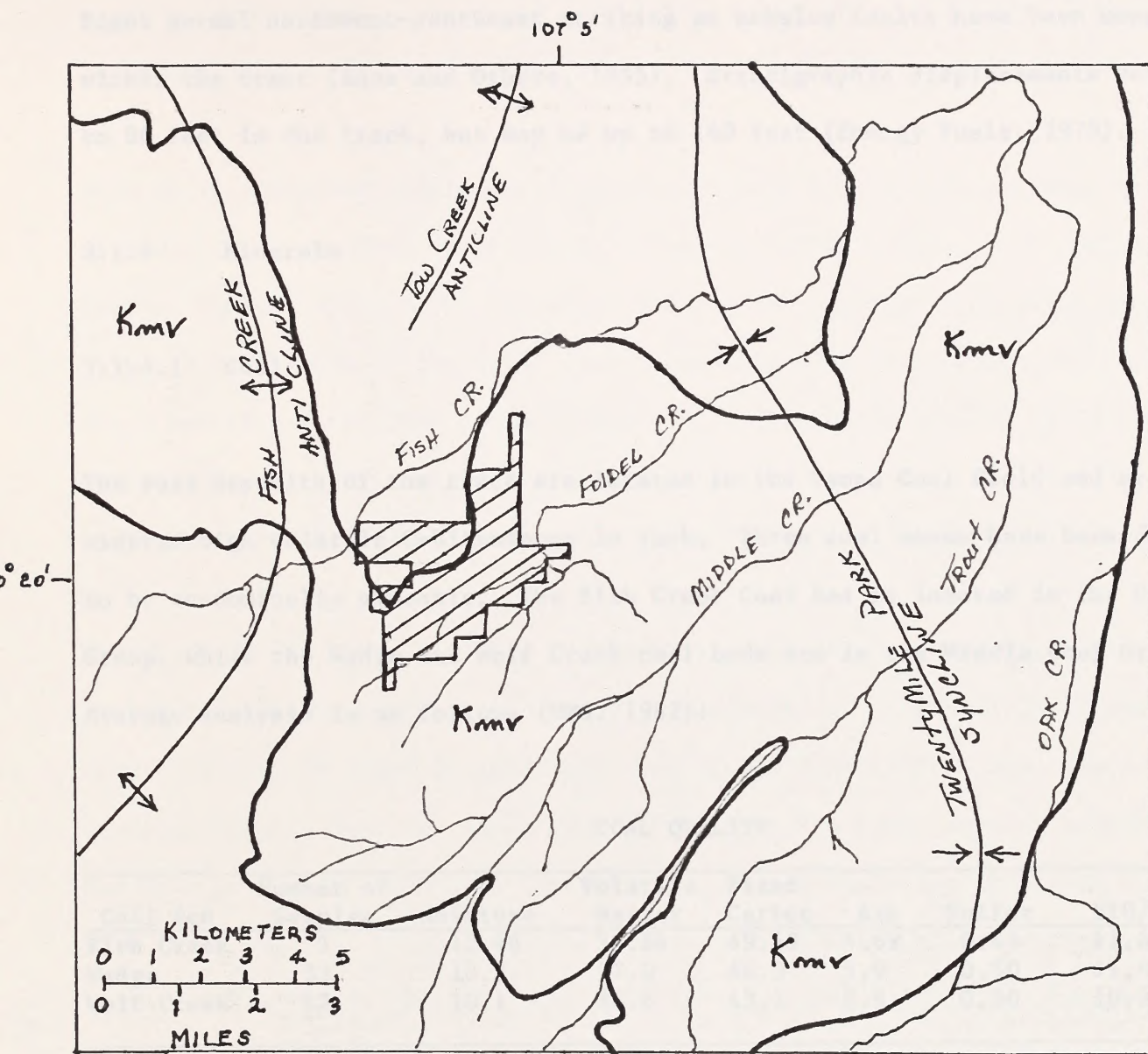


Figure 3-2.2. Structural Setting of the Fish Creek Tract. (Diagonal Ruling)
Kmv--Mesaverde Group

(Source: Adapted from BLM, Bureau of Rec., USGS, 1976)

Eight normal northwest-southeast striking en echelon faults have been mapped within the tract (Bass and Others, 1955). Stratigraphic displacements vary from 20 to 80 feet in the tract, but may be up to 140 feet (Energy Fuels, 1979).

3.1.4 Minerals

3.1.4.1 Coal

The coal deposits of the tract are located in the Yampa Coal Field and are considered high volatile C-bituminous in rank. Three coal seams have been determined to be economically mineable. The Fish Creek Coal bed is located in the Upper Coal Group, while the Wadge and Wolf Creek coal beds are in the Middle Coal Group. Average analysis is as follows (MMS, 1982):

COAL QUALITY

Coal Bed	Number of Samples	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	BTU/lb.
Fish Creek	5	12.48	35.84	49.49	4.69	0.44	11,697
Wadge	33	10.7	37.0	46.3	5.9	0.50	11,430
Wolf Creek	12	10.1	36.6	43.1	9.9	0.50	10,990

The Fish Creek coal bed has been leased for surface mining to the Colorado-Yampa Coal Company on two leases in the tract. The leases are (Figure 3-3):

C-20900

T. 5 N., R. 87 W.

Sec. 25: Lots 1, 2, 3, and 4 124.04 acres

C-29220

T. 5 N., R. 87 W.

Sec. 36: Lots 6-9 inclusive, 14, and 15 203.63 acres

T. 4 N., R. 86 W.

Sec. 7: Lots 5 and 6 68.96 acres

Lease C-20900 has been mined and is in the process of reclamation, while mining has not started on lease C-29220.

Coal data, including thickness of individual coal beds and overburden/interburden is presently considered proprietary. However, Colorado-Yampa Coal Company Mine Complex located adjacent to the tract (Fig. 3-3) is presently surface mining the Fish Creek Coal bed of the Upper Coal Group (Fig. 3-1). At Colorado-Yampa Mine No. 2 the Fish Creek coal bed averages 3 to 4 feet thick with 10 to 60 feet of overburden, exhibits good to fair lateral continuity (Energy Fuels, 1979), and is approximately 120 feet above the top of the Twentymile Sandstone.

The principal economic coal bed of the area is the Wadge seam (Fig. 3-1). This coal seam outcrops south of the tract in the adjacent Little Middle Creek tract (Fig. 3-3) and is found in the subsurface of the Fish Creek Tract. At Colorado-Yampa's Mine No. 1 and Eckman Park Mine the Wadge seam is presently or has been surface mined and is reported to range in thickness from 7 to 11 feet with 20 to 160 feet of overburden, good to excellent lateral continuity (Energy Fuels, 1979), and is located about 200 feet above the Trout Creek Sandstone. Overburden on the Wadge bed north of Foidel Creek ranges from 900 feet to over 1,200 feet.

The Wolf Creek coal bed lies 20 to 50 feet above the Trout Creek Sandstone and 150 to 180 feet below the Wadge coal bed. The Wolf Creek coal bed is considered uneconomical to mine at the Colorado-Yampa Mine complex because of poor lateral continuity, low BTU content, and high ash content (Energy Fuels, 1979).

However, the Wolf Creek coal bed has sufficient thickness and lateral continuity to be economically mineable in the Fish Creek Tract.

The Fish Creek coal bed is surface mineable, while the Wadge and Wolf Creek coal beds are mineable by subsurface methods on tract.

Total in place coal resources for the tract were computed by Minerals Management Service to be 138,708,000 tons. Estimated recoverable resources based on a 90% recovery of surface mineable reserves and a 50% recovery of underground resources is 64,275,000 tons.

3.1.4.2 Oil and Gas

No oil and gas drilling has taken place on tract; however, the area is considered potentially valuable for oil and gas production. Production from other pools and fields in the area include the Niobrara Shale, Mancos Formation, Dakota Sandstone, Morrison Formation, Entrada Sandstone, Shinarump Formation and the Weber Sandstone. All of these formations can be found at depth beneath the tract. One hundred twenty (120) acres of the tract are presently covered by oil and gas lease No. C-7796.

3.1.4.3 Locatable Minerals

Locatable minerals subject to the General Mining Law of 1872 are not known to exist on tract and none are expected to be encountered. A mining claim search revealed no claims on tract.

3.1.4.4 Saleable Minerals

Alluvium and colluvium deposits consisting of rock debris, and, silt and clay are found in the valleys and gulches of the tract. Quality and quantity of these deposits are unknown.

3.1.5 Paleontology

Fossils of the Mesaverde Group and the Lewis Shale have been characterized as common types having a wide stratigraphic range and a broad areal distribution. Those found include pelecypods, ammonites, leaf impressions, gastropods, crinoids and trace fossils (Collins, 1976, BLM, 1976) (Fig. 3-4).

3.2 Environmental Consequences

3.2.1 Geology

Impacts to the geology of the Fish Creek tract would be virtually identical in both scenario 1 and scenario 2.

The major impact to the geology of the tract would be the amount of coal mined, consumed and left underground as unrecoverable by present mining technology. An estimated 64 million tons of coal could be mined by both surface and underground methods. In addition, 74.4 million tons of coal would remain in the margins of the surface mine and mixed in the overburden and left in pillars and barriers of the underground operation.

ERAS	PERIODS AND SYSTEMS	EPOCHS AND SERIES	FORMATION	ENVIRONMENT	COMMON FOSSILS PRESENT	REFERENCES
CENOZOIC	TERTIARY	Miocene	Browns Park Formation	Fluvial Lacustrine; Eolian, Tuffs Airborne from Distant Volcanos	Ostracodes and Diatoms Vertebrate Fossils; Camel, Horse	Hansen, 1965 Peterson, 1928 McGrew, 1951
			Bishop Conglomerate	Fluvial	Non Fossiliferous	
		Eocene	Bridger Formation	Fluvial	Vertebrate Fossils	Gazin, 1959
			Green River Formation	Fluvial Lacustrine	Vertebrate Fossils Fossil Fish; Fossil Leaves & insects. Fresh Water Gastropods & Pelecypods	Robinson, 1974 Bradley, 1964
		Paleocene and Eocene	Wasatch Formation	Fluvial and Lacustrine	Vertebrate Fossils, mammals Some Ostracodes and Gastropods Fossil leaves, genus Aralia	Miser, 1929 McKenna, 1955
		Paleocene	Fort Union Formation	Fluvial in Part of Swamps and Marshes	Vertebrate fossils Fossil Leaves	Robinson, 1974 Hansen, 1965
			Ohio Creek Formation	Fluvial	Non Fossiliferous	
MESOZOIC	CRETACEOUS	Upper Cretaceous	Lance Formation	Fluvial import swamps	Non Fossiliferous A few leaf fossils Vertebrate fossils	Dorf, 1910 Robinson, 1974
			Lewis Shale	Marine off-shore	All Marine Fossils - Ammonites, Pelecypods, Crinoids, Gastropods.	Hancock, 1925 Miser, 1929 Dorf, 1938, 1942
			Williams Fork Formation	Fluvial in Part Swamps Littoral some Marine Shales	Fossil Plants from Genera Ficus, Myrica, Eriocaulon, & Salix. Fossil Leaves in Coal. Ammonites & Inoceramus Clams in Marine Shales. Pelecypods, Gastropods.	Hancock, 1925 Miser, 1929 Bass, Eby, Campbell, 1955
			Hiles Formation	Fluvial in Part Swamps Littoral some Marine Shales	Pelecypods, Fossil Leaves in Steamboat Springs & in the Coal Ammonites and Inoceramus Clams in Marine Shales - Fossil Plants of Genera Ficus & Halyzomenites.	Hancock, 1925 Miser, 1929 Bass, Eby, Campbell, 1955
			Mancos Shale	Marine Offshore	Ammonites--Baculites Scaphites, Inoceramus Clams, Pelecypods, Cephalopods	Hancock, 1925 Miser, 1929
			Frontier Sandstone	Marine Brackish Water	Pelecypods, Shark Teeth, and Plant Fossils	
		Lower Cretaceous	Mowry Shale Member of Mancos	Marine Offshore	Carbonized wood, Cyclord Fish Scales, Fish Bones	
			Dakota Sandstone	Fluvial, Marshes and Swamps	Silicified Wood, Ferns Dinosaur, Mollusk	Waage, 1959

FIGURE B-4

Fossiliferous formations in the study region.

The leasing of the surface and subsurface coal resources in the Fish Creek Tract should have no impact on the existing surface mining leases held by Colorado-Yampa Coal Company (C-20900 and C-29220) for the Fish Creek coal bed, because the existing leases and proposed lease are coal-bed specific and there is a minimum of 850 feet of competent interburden (including the Twentymile Sandstone) between the Fish Creek coal bed and the Wadge coal bed. The proposed leasing of this tract is coal-bed specific for surface mining of the Fish Creek coal bed (exclusive of leases C-20900 and C-29220) and the underground mining of the Wadge and Wolf Creek coal beds (includes subsurface leases C-20900 and C-29220). The leases and the relationship of the tract to Colorado-Yampa's coal mining operation is illustrated in Figure 3-3.

3.2.2 Topography

Destruction of the natural topography and disruption of the subsurface strata in the surface mined area of the Fish Creek coal bed would be unavoidable.

Backfilling and reclamation of the surface mined area would result in a natural appearing topography.

Underground mining of the Wadge and Wolf Creek coal beds by room and pillar method would minimize any noticeable surface affect of subsidence. The type of subsidence expected would be a gentle lowering of the ground surface and not the sinkhole or pothole type associated with extensive fracturing. This conclusion is based on subsidence studies conducted by Hunt (1978) and Sunland Mining Corporation (1981). Hunt studied case histories of coal mine subsidence in

Illinois and developed a model to predict potential subsidence. It should be noted that the overburden in Illinois coal mines is predominantly siltstone and shale that is not as competent as the overburden of coal mines in the Mesaverde Group. The Mesaverde group typically consists of about 50 percent thick (greater than 10 feet) moderately well- to well-cemented sandstone. For example, if the Wadge coal bed were mined by room and pillar method at a 50 percent extraction rate and with a panel width/mining depth ratio of 0.5, the subsidence expected would be 15 percent or less of the mining height. Therefore, if the mining height is ten feet and the mining depth is 600 feet (panel width = 300 feet), the maximum expected lowering of the surface would be 1.5 feet. However, the actual subsidence should be less, because the model was developed from mines having overburden of low competency.

Trough type subsidence of the magnitude anticipated should not have extensive vertical fracturing or extensive vertical fault displacements. A vertical displacement of a few feet in the Twentymile Sandstone would not greatly interrupt groundwater flow, since the aquifer is about 115 feet thick in the tract. The displacement of impermeable interburden materials, shale and siltstone, should not significantly increase the vertical movement of groundwater along faults. The weight of the overburden and resultant pressures would cause the shale/siltstone interburden material to flow and anneal the faults caused by subsidence.

State and Federal Regulations (Colorado Surface Coal Mining Reclamation Act, 34-33-101 et seq. and Public Land 95-87; 30CFR784.20; 30CFR211.31 a and c) require monitoring of subsidence for the life of the mine.

3.2.3 Landslides

The northwest portion of the tract (T. 5 N., R. 86 W., Sections 11 and 12) was mapped by Colton and Others (1975) as inferred to be underlain by landslide deposits. The type and stability of these deposits is not known. The potential geologic hazards associated with surface mining through these deposits is not known, but it should be noted that Colorado-Yampa Coal has mined the Fish Creek coal bed in lease No. C-20900 in T. 5 N., R. 87 W., Section 25, through landslide deposits. However, since the surface slopes are generally less than five degrees and the lease has been mined through landslide deposits, no significant geologic hazards associated with the landslides is known to have occurred. The potential for rock slides into the mine areas is anticipated to be low because the dip averages a gentle six degrees. The majority of the coal would be mined underground and, in view of present reclamation requirements, no significant geologic hazards associated with landslides are expected on tract.

3.2.4 Faults

Geologic hazards associated with recurrent fault movement is not expected because the tract is located in a zone of low seismicity. The only problems associated with faulting are the vertical offset of coal beds and the possibility of faults acting as conduits for groundwater. These problems can be alleviated or avoided by proper mine engineering design.

3.2.5 Paleontological Resources

The disturbance of paleontological resources would result in both adverse and beneficial impacts. Some fossils would be destroyed but others would be discovered. Due to the common nature of the fossils expected to be disturbed, neither the adverse nor the beneficial affects would be significant.

3.2.6 Irreversible/Irretrievable Commitment of Resources

The coal mined, consumed, and left underground as unrecoverable due to present technology would be irretrievably lost to future use. An estimated 64 million tons of coal could be permanently removed leaving an additional 74.4 million tons of coal mixed in the overburden and in the margins of the surface mine and left in pillars and barriers of the underground operation.

The natural topography and the subsurface strata would be irreversibly altered in the surface mined area. The natural topography and the subsurface strata could also be irreversibly altered above the underground operations if subsidence occurs.

Fossils destroyed, vandalized and stolen would be irretrievably lost to research and educational uses.

3.2.7 Short Term Use vs. Long Term Productivity

Short term use of the tract for the mining of coal would mean the permanent loss of 64 million tons of mined coal plus an additional 74.4 million tons, considered unrecoverable, left underground. If coal is not mined at present, improvements in mining technology could increase long term coal productivity.

3.2.8 Committed Mitigation - Paleontology

(1) Before undertaking any surface-disturbing activities on the leased lands, the lessee shall contact the appropriate District Office of the Bureau of Land Management to determine if the leased lands fall within a Class I-a or Class I-b paleontological classification area.

(2) If the leased lands fall within a Class I-a or Class I-b area or in areas not classified yet, a paleontological survey shall be required to establish the presence or absence of scientifically significant fossils as defined in IM CO-80-388. No paleontological surveys will be required in Class II or Class III areas.

(3) The paleontological survey shall be conducted by the appropriate BLM district and/or area geologist, if available. Otherwise, it shall be conducted by a qualified paleontologist approved by the BLM district geologist.

(4) If scientifically significant fossils are encountered during the survey, the lessee's mining plan shall address appropriate steps for salvaging and/or avoiding the fossils.

(5) Should any vertebrate fossils be uncovered during any surface-disturbing activities or during any mining operations, the BLM district geologist shall be contacted immediately, as well as the Administrator of the Western Technical Center (OSM), or the District Mining Supervisor, as appropriate. Operations may continue as long as the fossils are not destroyed or lost by the activity. An

evaluation of the fossils shall be completed by the BLM district geologist or a BLM-approved paleontologist within five working days, and the lessee will be notified of what actions will be taken.

(6) All scientifically significant fossils shall remain under the jurisdiction of the United States until ownership is determined under applicable law. Copies of all paleontological resource data generated as a result of the lease term requirements shall be provided to the BLM district geologist, and to the Administrator of the Western Technical Center (OSM), or the District Mining Supervisor, as appropriate.

(7) The cost of any required salvage of such fossils shall be borne by the United States.

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THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: Surface & Underground

Resource Element	Committed Mitigation	Baseline	Anticipated 1992 1995	Impact 2000 EML	Data Reliability	Irretrievable Commitments	Irreversible and Commitments	Comments (Context) (Proposed Mitigation)
Geologic Hazards		Low	----->		Good			Slopes generally less than 5°, although dip-slope conditions do exist.
Seismic Activity		None	----->		Good			No active faults; low zone of seismicity.
Subsidence Potential	See narrative	Low-Moderate	----->		Fair		Possible loss of natural topography and modification of sub-surface.	Very low subsidence potential north of Foidel Creek. Low potential for subsidence south of Foidel Creek. If underground mining occurs there.
Potential For Other Minerals	Multi-mineral Development Act	None			Fair			No present conflicts.
Paleontology	See Narrative	Low	----->		Fair		Loss of Fossil Remains	Beneficial affect of exposure.

4 Soils

4.1 Affected Environment

The soils within the tract are extremely variable depending on parent materials, slopes, aspect and location on slopes. The soils on tract are formed primarily from weathered fine grained sandstone, shale and some siltstone with additional material derived from water deposited alluvium and windblown sands. Three major soil types are recognized on the tract. The parent materials and topographic position are the primary factors differentiating the major soils (USDI 1976). These soils are designated as follows: 1) Soils forming on sandstone and occupying gently sloping to strongly sloping mountain foothills, which are generally coarse textured, moderately deep to deep, are highly suited as a source of plant growth media. They are low in alkaline and saline salts. These deep soils are primarily cryoborolls, meaning they are cool to cold with a mean annual soil temperature less than 8°C (46° F). These soils are intermittently moist during the growing season. 2) The second major soil type occurs on shaley formations which occupy gently sloping to moderately sloping, smoothly rounded uplands generally on landscape positions below soils formed on sandstone. These soils are fine textured, heavy clay loams to clays with poor physical conditions which limit their suitability as plant growth media during reclamation. They are generally shallow to moderately deep (18" to 40") over shale. 3) The third major soil type is alluvial soils of mixed sedimentary origin which occupy the stream valleys and drainage ways. They vary widely in their physical characteristics due to the variations in parent materials, as well as the depth of alluvial deposition within these valleys. These soils are fair sources of plant growth media limited by heavy textures, slow permeability

and infiltration rates. There are also steep to very steep upland soils occupying nearly barren hillsides and ridgetops. Escarpment faces and vertical sandstone ledges are also found on tract. These areas are unsuitable sources of topsoil due to steep slopes and shallow depths of topsoil.

Much of the overburden on tract is rated as potentially suitable for use as plant growth media. However, wherever suitable topsoil exists in sufficient quantities, it could be utilized as priority plant growth media. Since sufficient topsoil is available, overburden material would not be considered as a source of plant growth media (USDI 1976).

The Soil Conservation Service has completed a detailed soil survey of the tract area and the series descriptions used in this report are contained in the Routt County Soil Survey Report (manuscript subject to revision). The tract contains 28 mapping units; refer to the Soils Map Legend (Table 4.1) and the Soils Map (Figure 4.1). Included in these 28 mapping units, are 20 which are mapped at the series level, six which are mapped as complexes of soil series, and two mapping units which are miscellaneous landforms. Included on the tract are individual series which have been combined as complexes or separated by slope breaks or surface textures. The physical characteristics and soil limitations for reclamation on the tract have been condensed. From the Routt County Soil Survey Report and SCS Interpretation Records, Table 4-2 and Table 4-3 are shown respectively.

4.1.1 Prime and Unique Farmlands

There are no known prime and unique farmlands occurring on tract; however, prime and unique farmland mapping has not been completed in Routt County.

Table 4.1

SOILS MAP LEGENDFISH CREEK COAL TRACT

Routt County

<u>Symbol</u>	<u>Mapping Unit Name</u>
ML	Mined Lands.
2VD	Routt loam, 3-25% slopes.
2C	Unnamed loam, 3-12% slopes.
2E	Unnamed loam, 12-25% slopes.
X8D	Winevada-Splitro complex, 3-25% slopes.
X8F	Winevada-Splitro complex, 25-65% slopes.
X10F	Abor-Moyerson silty clay loam, 25-65% slopes.
C10	Binco silty clay loam, 3-12% slopes.
D10	Binco silty clay loam, 12-25% slopes.
F10	Binco silty clay loam, 25-65% slopes.
23A	Gapco clay loam, 0-3% slopes.
27A	Unnamed sandy loam, 1-10% slopes.
34E	Coutis fine sandy loam, 12-25% slopes.
34F	Coutis fine sandy loam, 25-65% slopes.
35C	Aaberg silty clay, 3-12% slopes.
35D	Aaberg silty clay, 12-25% slopes.
35F	Aaberg silty clay, 25-65% slopes.
50C	Cochetopa loam, 3-12% slopes.
50E	Cochetopa loam, 12-25% slopes.
53D	Winevada fine sandy loam, 3-25% slopes.
56A	Tonks loam, 0-5% slopes.
66D	Skylick loam, 3-25% slopes.
68C	Unnamed sandy loam, 3-12% slopes.
68D	Unnamed sandy loam, 12-25% slopes.
99	Cryoborolls - Rock outcrop.
101	Torriorthents - Rock outcrop complex, very steep.
103	Roxal Variant - Lymanson- Starman complex, 37-75% slopes.

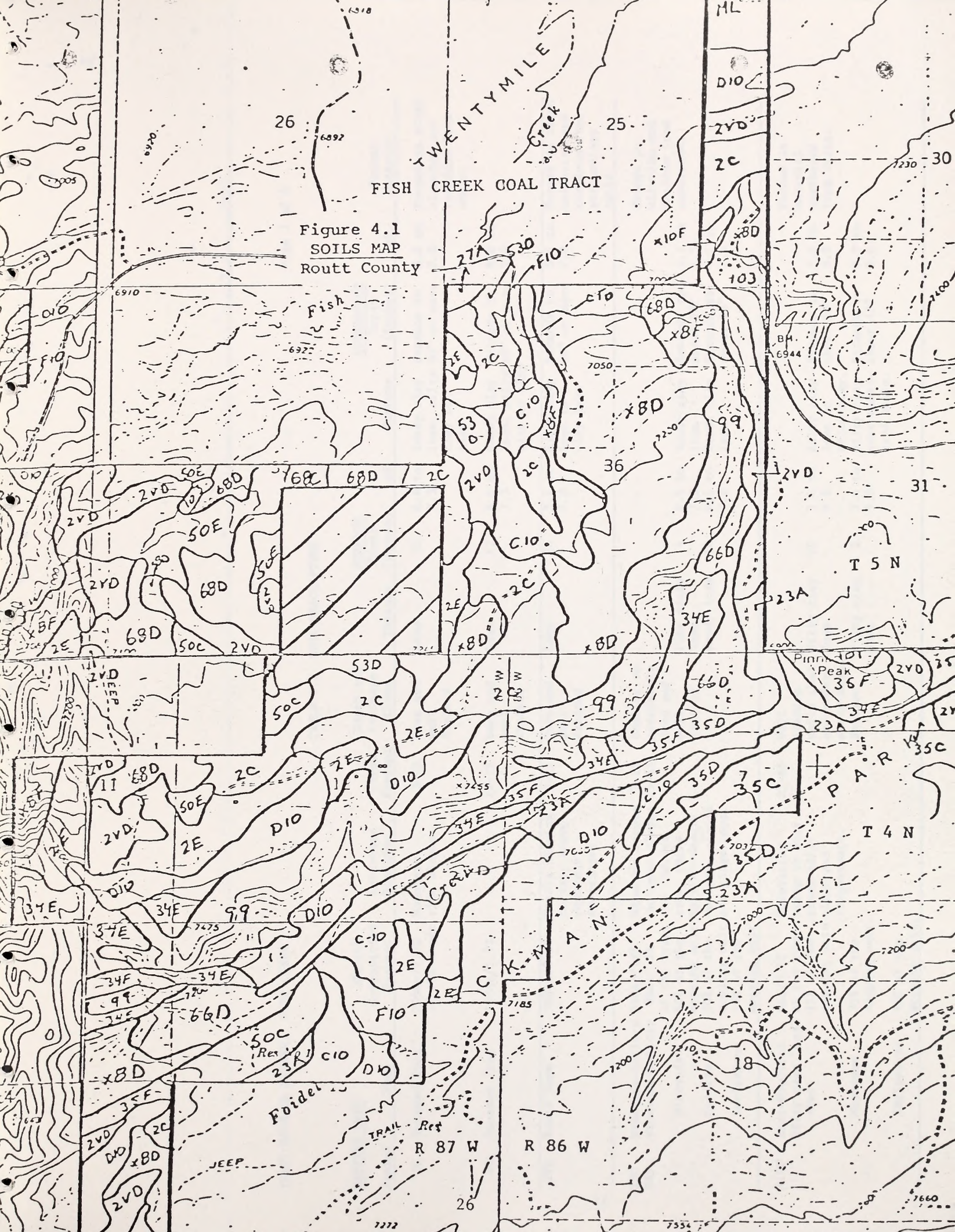


TABLE 4.2 SOIL DESCRIPTORS

MAPPING UNIT			Extent Composition Percent	Landscape Position	Slope Percent	Depth and Drainage Class	SURFACE		SUBSURFACE		Parent Material	
Symbol	Name	Texture					Depth (Inches)	pH	Texture	Depth (Inches)		pH
2C	Unnamed loam	209Ac/7.3% of the tract side slopes	Mountain	3-12	Deep and well drained	Loam	12	6.6 to 7.3	Sandy clay loam, silty clay to clay	Extends to 60" or more	6.6 to 7.8	Formed in mixed alluvium and residuum from shale.
2E	Unnamed loam	162Ac/5.7%		12-25	Deep and well drained	Loam	12	6.6 to 7.3	Sandy clay loam, silty clay to clay	Extends to 60" or more	6.6 to 7.8	
2VD	Routt loam	260Ac/9.1%	Gently sloping to very steep mountain sideslopes	3-25	Deep and well drained	Loam	26	5.6 to 7.8	Silty clay loam to clay loam	Extends to 60' or more	5.6 to 7.8	Formed in mixed colluvium and residuum from sedimentary rocks
X8D	Winevada-Splitro	340Ac/12%	Winevada occurs on lower slopes	3-25	Shallow to moderately deep and well drained							Formed in alluvium and residuum from sandstone.
X8F	Winevada-Splitro	88Ac/ 3%	of the tract and concave areas while Splitro occurs on upper slopes	25-65		Fine sandy loam Sandy loam	4 10	6.6 to 7.3 6.1 to 7.8	Sandy clay loam Sandy clay loam	Extends to about 24" Extends to about 18"	6.3 to 7.3 6.1 to 7.8	
	Inclusions	30% of the mapping unit and ridge tops. 10% of the mapping unit										
X10F	Abor-Moyerson Silty clay loam Abor	6Ac/0.2% of the tract 55% of the mapping unit steep hill- sides and ridgecrests.	Moderately steep to very steep hill- sides and ridgecrests.	25-65	Well drained soils that are moder- ately deep. Shallow							Formed in material weathered from shale.
	Moyerson	35% of the mapping unit.				Silty clay loam	2	7.4 to 9.0	Silty clay over weath- ered shale.	Extends to about 13"	7.9 to 9.0	
	Inclusions	10% of the mapping unit.										

TABLE 4.2 SOIL DESCRIPTORS

MAPPING UNIT		Extent Composition Percent	Landscape Position	Slope Percent	Depth and Drainage Class	SURFACE		SUBSURFACE		Parent Material
Symbol	Name					Texture	Depth (Inches)	Texture	Depth (Inches)	
C10	Binco silty clay loam	148Ac/5.2%	Gently sloping to moderately steep and very steep benches, ridges and mountain side slopes	3-12	Deep and well drained	Silty clay loam	4	Clay	Extends to about 60"	7.9 to 8.4 Formed in material weathered from shale.
D10	Binco silty clay loam	307Ac/11%		12-25	"	"	4	"	"	"
F10	Binco silty clay	67Ac/23%		25-65	"	"	4	"	"	"
23A	Gapo clay loam	109Ac/4%	Nearly level to gently sloping valley floors.	0-3	Deep and poorly drained.	Clay loam to clay	20	Stratified clay	Extends to 60" or more	7.9 to 8.4 Formed in fine textured alluvium.
27A	Unnamed sand/loam	4Ac/.1% of the tract	Nearly level to sloping valley floors.	1-10	Deep and well	Sandy loam	14	Sandy clay loam	Extends to about 60"	7.3 to 7.8 Formed in alluvium from mixed sources.
34E	Coutis fine sandy loam	147Ac/5.1%	Gently to strongly sloping mountain side slopes	12-25	Deep and excessively drained	Fine sandy loam	25	Fine sandy loam	Extends to about 60"	6.6 to 7.8 Formed in residuum from weathered sandstone.
34F	Coutis Fine sandy loam	9Ac/0.3%		25-65		Fine sandy loam	25	Fine Sandy loam	Extends to about 60"	6.6 to 7.8
35C	Aaberg silty clay	65Ac/2.2%	Gently to strongly sloping hillsides	3-12	Moderately deep and well drained	Silty clay	2	Silty clay	Extends to about 35"	7.8 to 8.4 Formed on weathered shale and siltstone.
35D	Aaberg silty clay	55Ac/2%		2-25	drained	Silty clay	2	Silty Clay	Extends to about 35"	7.8 to 8.4
35F	Aabery silty clay	57Ac/2%		25-65		Silty clay	2	Silty Clay	Extends to about 35"	7.8 to 8.4

TABLE 4.2 SOIL DESCRIPTORS

MAPPING UNIT		Extent Composition Percent	Landscape Position	Slope Percent	Depth and Drainage Class	SURFACE		SUBSURFACE		Parent Material
Symbol	Name					Texture	Depth (Inches)	Texture	Depth (Inches)	
50C	Cochetopa loam	54Ac/2% of the tract	Gently sloping to steep benches and mountain	3-12	Deep and well drained	Loam	18 7.3	Clay loam	Extends to about 60"	6.1 to 7.3 Formed on weathered shale.
50E	Cochetopa loam	84Ac/3% of the tract		12-25	Deep and well drained	Loam	18 7.3	Clay loam	Extends to about 60"	6.1 to 7.3
53D	Winevada Fine sandy loam	36Ac/1.2% of the tract	Gently to strong sloping benches and mountain side slopes	3-25	Moderately deep and well	Fine sandy loam	4 7.3	Sandy clay loam	Extends to about 24"	6.3 to 7.3 Formed in material from sandstone.
56A	Tonks loam	2Ac/0.1% of the tract	Nearly level to gently slop- ing valley floors	0-5	Deep and poorly drained	Loam	12 9.0	Sandy clay loam	Extends to 60" or more	7.9 to 9.0 Formed in mixed alluvium.
66D	Skylick loam	101Ac/3.5% of the tract	Gently sloping to strongly sloping benches and side slopes	3-25	Deep and well drained	Loam	24 6.5	Light clay loam	Extends to 60" or more	6.1 to 7.3 Formed on weathered shale
68C	Unnamed sandy loam	6Ac/0.2% of the tract	Gently to strongly sloping	3-12	Deep and well	Sandy loam	10 7.3	Sandy clay loam	Extends to 60" or more	6.6 to 7.3 Formed on weathered sandstone
68D	Unnamed sandy loam	114Ac/4% of the tract	mountain side slopes	12-25	drained	Sandy loam	10 7.3	Sandy clay loam	Extends to 60" or more	6.6 to 7.3

TABLE 4.2 SOIL DESCRIPTORS

MAPPING UNIT		Extent Composition Percent	Landscape Position	Slope Percent	Depth and Drainage Class	SURFACE		SUBSURFACE		Parent Material
Symbol	Name					Texture	Depth (Inches)	Texture	Depth (Inches)	
99	Cryoborolls- Rockoutcrop Cryoborolls Rockoutcrop Inclusions	324Ac/11% of the tract to very steep 50% of the slopes on north mapping unit and west valley 30% of the sideslopes and mapping unit ridges 20% of the mapping unit	Moderately steep to very steep slopes on north mapping unit and west valley sideslopes and ridges	15-90	Shallow to deep and well drained	Loams to loams	8-20 0-4	Varied Sandy clay loams, clay loams or clays	Varied Extends from 10-60"	Formed on interbedded sandstone and shale
101	Torriothents- Rockoutcrop Torriorthents Rockoutcrop Inclusions	4Ac/0.1% of the tract 50% of the mapping unit 40% of the mapping unit 10% of the mapping unit	Strongly sloping to very steep, occurring on terrace and es- carpment faces and valley sideslopes	25-90	Shallow to moderately deep and well drained	Coarse to medium textures with stones and cobbles	0-5 0-5	Varied varied loams or clays	Extends 10-40" Less than 4" deep	Alluvium and colluvium. Sedimentary rock ledges.
103	Roxal Variant- Starman Complex Roxal Variant Lymanson Starman Inclusions	27Ac/1.0% of the tract 35% of the mapping unit 30% of the mapping unit 20% of the mapping unit 15% of the mapping unit	Steep to very steep mountain sideslopes Stream and of the tract river terraces	35-75	Shallow to moderately deep and well	Sandy loam Loam Very sandy cobble loam	2 2 3	7.4- 8.4 6.6- 7.3 7.4- 9.0	Extends to about 27" clay loam Heavy loam to silty clay loam Extremely cobble sandy loam	Formed in place from shale Formed in place from shale Formed from weathered sandstone
AW	Cumelic Hapla- guolls occasion- ally flooded	38Ac/1.3% of the tract	Stream and river terraces	0-5	Deep and poorly drained	Loam	16	6.4- 7.5	Extends to 60" or more	Alluvium from mixed sedi- mentary rocks.
ML	Mined land	33Ac/1.1%	Gently sloping	0-60	Varied					

TABLE 4.3 SOIL LIMITATION

Symbol	Name	Available Water Hold- ing Capacity	Rate of Surface Runoff	Undisturbed Erosion Hazard	Erosion Factor		Surface Erodibility Group	Shrink Swell Potential	Physical Limitations
					K	T			
2C	Unnamed loam	High	Slow	Moderate	.32-	5	5		Low on surface Clayey subsoils and steep slopes limit the use of this soil for roadfill and topsoil.
2E	Unnamed loam	High	Medium	High	.37				
2VD	Routt loam	High	Medium	High	.28	5	5		Low on surface face, high in textures limit the use of this soil for roadfill and topsoil.
X8D	Winevada-Splitro								Shallow depth of topsoil and steep slope make this unit a poor source for roadfill and topsoil.
X8F	Winevada-Splitro	Low	Medium	High	.15-	3		Low	
	Winevada			Moderate	.24				
	Splitro	Low	Medium	High	.20	1	3	Low	
X10F	Abor-Moyerson								Poor source for roadfill and topsoil due to steep slopes, shallow topsoil and heavy clay content with high shrink swell, low strength and Moyerson contains excessive sodium.
	Silty clay loam	Low	Rapid	High	.37-	2	4	High	
	Abor				.43				
	Moyerson	Very low	Rapid	High	.28	1	4	High	

TABLE 4.3 SOIL LIMITATION

Symbol	Name	Available Water Holding Capacity	Rate of Surface Runoff	Undisturbed Erosion Hazard	Erosion Factor K	T	Surface Erodibility Group	Wind Shrink Potential	Physical Limitations
C10	Binco Silty Clay Loam	Moderate	Medium	Moderate	.32	5	4	Moderate on surface; high shrink swell in subsoil.	Steep slopes and heavy clay subsoils with high shrink swell and high erosion hazard are severe limitations for use as roadfill and topsoil.
D10	Binco Silty Clay Loam	Moderate	Medium to rapid	Moderate	.32	5	4		
F10	Binco silty clay Loam	Moderate	Rapid	High	.32	5	4		
23A	Gapo Clay Loam	Moderate	Slow	Low	.32	-	8	High	Wetness and heavy clay textures make this unit unsuitable for topsoil and roadfill.
27A	Unnamed sandy Loam	Moderate	Slow	Slight	.17- .28	5	-	Low	Large content of coarse fragments make topsoil handling difficult.
34E	Coutis Fine Sandy Loam	Moderate	Slow	High from wind and low from water.	.20	5	3	Low	Good source for topsoil on slopes less than 8 percent and poor on slopes greater than 15 percent.
34F	Coutis Fine Sandy Loam	Moderate	Medium	High from wind; moderate from water	.20	5	3	Low	
35C	Aaberg Silty Clay Low	Low	Medium	Moderate	.37- .43	3	-	High	Heavy clays which create problems of high shrink swell, low strength, limit the use of this soil for topsoil and roadfill.
35D	Aaberg Silty Clay Low	Low	Medium	High	.37- .43	3	-	High	
35F	Aaberg Silty Clay Low	Low	Rapid	High	.37- .43	3	-	High	

TABLE 4.3 SOIL LIMITATION

Symbol	Name	Available Water Hold- ing Capacity	Rate of Surface Runoff	Undisturbed Erosion Hazard	Erosion Factor K	T	Surface Wind Erodibility Group	Shrink Swell Potential	Physical Limitations
50C	Cochetopa Loam	High	Slow	Slight	.28- .43	5	-	Low on surface and high in subsoil.	Poor source for roadfill and topsoil due to high clay content in subsoil and slopes in excess of 25%.
50E	Cochetopa Loam	High	Rapid	High	.28- .43	5	-	Low on surface and high in subsoil.	
53D	Winevada Fine Sandy Loam	Low	Slow	Moderate	.15- .24	3	-	Low	Shallow depth of topsoil is the greatest limitation on this soil.
56A	Tonks Loam	High	Ponded or slow	Slight	.28	5	8	Low	Wetness and frost action are the greatest limitations on this mapping unit.
66D	Skylick Loam	High	Slow to High	High	.32- .37	5	6	Moderate	Good source for topsoil and roadfill but slope becomes limiting about 15%.
68C	Unnamed Sandy Loam	Moderate	Slow	Moderate	.15- .24	5	-	Low	Excessive fines make this soil a fair source for topsoil and roadfill.
68D	Unnamed Sandy Loam	Moderate	Medium	High	.15- .24	5	-	Low	

TABLE 4.3 SOIL LIMITATION

Symbol	Name	Available Water Holding Capacity	Rate of Surface Runoff	Undisturbed Erosion Hazard	Erosion Factor K	T	Surface Erodibility Group	Wind Shrink Swell Potential	Physical Limitations
99	Cryoborolls- Rockoutcrop Complex	Low to High	Medium	Moderate from wind, high from water	--	--	Varied	Varied	This soil is subject to slumps, in addition, steep slopes and shallow depth of topsoil make this unit a poor source for roadfill and topsoil.
	Cryoborolls								
	Rockoutcrop	Very low	Rapid		--	--	--	--	
101	Torriortheints- Rockoutcrop Complex								Very steep and shallow undeveloped soils and barren rock create very severe limitation for any use.
	Torriortheints	Low	Moderate to rapid	High	--	--	High	Low to high	
	Rockoutcrop	Very low	Very rapid	Low	--	--	Low		
103	Roxal Variant- Lymanson Starman Complex								Steep slopes of this unit, all of which are over 35%, and shallow depth of topsoil limit the use of this complex for any purpose. Roxal Variant and Lymanson soil are further limited for use as top- soil and roadfill due to clayey subsoil. Starman soil has severe limitations for use as topsoil due to high content of coarse fragments.
	Roxal Variant	Low	Rapid	High	.32	2	--	Low to high	
	Lymanson	Low	Rapid	High	.24- .32	2	--	Low to moderate	
	Starman	Low	Rapid	High	.24- .28	1	4L	Low	
AW	Cumelic Hapla- quolls Occasionally flooded	Very high	Slow	Slight	--	--	--	Low	Occasionally flooded, water table within 10 inches of the surface, creates severe limitations for any use.
ML	Mined Land	Varied							

4.2 Environmental Consequences

Impacts to the soils arising from expanding the existing surface mine and development of an underground mine (Scenario #1) would be similar to starting a new surface and underground mine (Scenario #2). Both Scenarios would result in the disruption and removal of existing soils on 200 acres where surface mining would occur (Map 2). Additional disturbance for construction of facilities, haulroads, and topsoil stockpiles would be 100 acres for Scenario #2, and 25 acres for Scenario #1 (Map 2). By end of mine life, 225 acres and 300 acres disturbance would result for Scenario #1 and Scenario #2 respectively.

Disturbances (topsoil handling and overburden removal) on the tract could result in alteration of productivity, by mixing soils, loss of soil profiles, and creation of a more homogenous textured soils. Also, changes in numbers and diversity of the soil microbiota could alter the nutrient-energy cycling, which has a large influence on soil fertility. This problem has not been documented in Northwest Colorado, nor has it been expressed as a problem by the adjacent mine operated by Colorado Yampa Coal Company.

Surface mining would involve 153 acres and 171 acres (Scenarios 1 and 2 respectively) of soils that are truncated as a result of agricultural practices (See Section 13, Land Use). This means that topsoils have already been disturbed to a depth of approximately 12"; therefore, the natural soil profile to this depth has already been lost. Because of this agriculture practice, it may be assumed that soils are not a limiting factor in production.

The remaining acreage is covered by soils units 68D, 27A, 2C, 99, 103, and 2VD, which are moderately deep to deep loams and clay loams. These soils have physical and chemical properties that would be generally suited for revegetation (USDI, 1976). Both overburden and subsoils could also provide a suitable plant growth media (USDI, 1976).

Reclamation potential for this area would be good, as evidenced by reclamation efforts of Colorado Yampa Coal Company on their adjacent mines. This operator and their predecessor, Energy Fuels Corporation, has reclaimed approximately 1,000 acres of similar soils and topography with very good success. Adjacent lands that have been mined in Section 25, T. 5 N., R. 87 W., have been released for bond.

Because of demonstrated success of reclamation in this area, available suitable plant growth media, and existing reclamation regulation requirements, this area would be reclaimed to the same or better productivity than before mining.

4.2.2 Short Term vs. Long Term Productivity

After reclamation of the disturbed areas, initial productivity would be expected to return. It is estimated that productivity would reach former levels within 10 years following reclamation activities.

4.2.3 Irreversible and Irretrievable Commitment of Resources

See Attachment 2A.

REFERENCES

- Energy Fuels Corporation, 1979. Mining and Reclamation Plan, Steamboat Springs, Colorado 80477. Klein, D.A., D.L. Sorenson, and W. Metzger. 1982. Soil Micro-organisms and Management of Retorted Shale Reclamation. In Revegetation Studies on Oil Shale Related Disturbances in Colorado. Editors: Ed F. Redente and C.W. Cook. Dept. of Range Science, Colorado State University, Fort Collins, Colorado. pg. 21-44
- Soil Survey Staff, 1975. Soil Taxonomy. USDA Soil Conservation Service, U.S. Government Printing Office, Washington, D.C., Ag. Handbook No. 436. pg 754
- U.S. Dept. of Agriculture. Soil Conservation Service Soil Survey Report for Routt County (unpublished)
- USDI 1976. Resource and Potential Reclamation Evaluation Foidel Creek Study Site, Emria Report N. 6, Denver, Colorado

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: #1-Continuation of Surface and Underground Mine; #2-New Surface and Underground Mine

Resource Element	Committed Mitigation	Anticipated Impact			Data Reliability	Irreversible and Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line 1985	1992	1995			
Prime and Unique Farmlands	USDA, SCS Public Law 45-87, Section 657.5	Unknown	Unk	Unk	Unk	Unk	None
Soils:							
Erosion Potentials #1	Federal (OSM, SMCRA) State, (CMLRB) and	3-5 tons/Ac/Yr	225Ac	225Ac	225Ac	225Ac	The increased erosion rate of 10-15 tons/Ac/yr would be irretrievably displaced.
#2			100Ac	300Ac	300Ac	300Ac	
Chemical							
Limitations Federal (OSM, SMCRA) State, (CMLRB) and Local Reclamation Regulations	Good; Possible alteration of soil micro-biota by topsoil stockpiling	Unk	Unk	Unk	Unk	Unk	See text. Chemical limitations may be encountered by stockpiling topsoil but these limitations could be overcome by shortening the period of stockpiling and inoculation of adapted strain of microbiota.
Physical							
Limitations Public Law 95-87 Federal (OSM, SMCRA) State, (CMLRB) and Local Reclamation Regulations	None	0	0	0	0	0	See text.

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: #1-Continuation of Surface and Underground Mine; #2-New Surface and Underground Mine

Resource Element	Committed Mitigation	Anticipated			Impact	Data Reliability	Irreversible and Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line 1985	1992	1995	2000			

Physical Profile None Developed soil horizons and functioning nutrient-energy cycling.

Good, Routt County Soil Survey Report

Complete alteration Insignificant.

#1

225Ac 225Ac 225Ac 225Ac

#2

100Ac 300Ac 300Ac 300Ac

soils with altered physical and chemical properties of soil structure, texture, permeability, infiltration rates, effective routing depths, microclimate and nutrient and energy cycling.

Suitability of Plant Growth Media Federal (OSM, SMCRA) State, (CMLRB) and Local Reclamation Regulations Good; moderately deep to deep loams and clay loams.

Good SCS Routt County Soil Survey Report

0 0 0 0

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: #1-Continuation of Surface and Underground Mine; #2-New Surface and Underground Mine

Resource Element	Committed Mitigation	Anticipated			Impact	Data Reliability	Irreversible and Irrecoverable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line 1985	1992	1995	2000			
Availability of Plant Growth Media	Federal (OSM,SMCRA) Adequate; State, (CMLRB) and Local Reclamation Regulations	0	0	0	0	Good SCS Routh County Soil Survey Report		See text; subsoil and overburden could also provide suitable sources of plant growth media.
Occurrence of toxic elements	Federal (OSM,SMCRA) and state (CMLRB) and Local Reclamation Regulations	Unknown	Unk	Unk	Unk	Poor		Toxic elements that might be uncovered will have to be buried below the rooting zone.
Land Use Planning Stipulations	None	None	None	None	None	Good	None	None
Proposed mitigation	Federal (OSM,SMCRA) state (CMLRB) and Local Reclamation Regulations	None	None	None	None	Good	None	Reclamation regulations
Reclamation Regulations								
Potential back to present use	Federal (OSM,SMCRA) and state (CMLRB) and Local Reclamation Regulations	Good	0	0	0	Good Little Snake Resource Area		Large areas of disturbance and reclamation has successfully occurred in the area.
Potential back to other uses	Federal (OSM,SMCRA) Dryland Farming and Local Reclamation Regulations	Unk	Unk	Unk	Unk	Natural Resource Specialists; Energy Fuels Corp. (1979)	Good	

5 Water Resources

5.1 Affected Environment

5.1.1 Surface Water

Within the tract are parts of two watersheds which drain northward to the Yampa River. Ephemeral tributaries drain most of the tract to Foidel and Fish Creeks.

Foidel Creek starts its flow period in March when snowmelt occurs. Runoff is heaviest March through June, when the combination of snowmelt and rainfall yield runoff volumes in excess of 6.0 cubic feet per second (cfs). In July the runoff decreases rapidly to near zero, and by mid-July the streams cease flowing except for the occasional runoff from summer thundershowers. The lack of baseflow during the dry months indicates that alluvial groundwater is not contributed to Foidel Creek. During the months of November through March, the streams are frozen well below the streambed resulting in no flow. From the data collected and from field observations, the lower reaches of Foidel Creek are classified as intermittent streams with streambeds above the water table (Energy Fuels, 1979).

Records for four U.S.G.S. gaging stations surrounding the tract are summarized in Table 5-1. Data from station 09243800, Foidel Creek, indicates that runoff from the upper reaches of the watershed yield about .04 acre-feet per acre per year or about 56 ac-ft per year from the Foidel portion of the tract which is about 1,400 acres.

TABLE 5-1

U.S.G.S. SURFACE WATER GAGING DATA

	USGS Station 09243700 <u>Middle Creek</u>	USGS Station 09243800 <u>Foidel Creek</u>	USGS Station 09243900 <u>Foidel Creek</u>	USGS Station 09244100 <u>Fish Creek</u>
Yrs. of Record	1976-1981	1976-1980	1976-1980	1956-1973
Drainage Area	23.5 sq. mi.	8.61 sq. mi.	17.5 sq. mi.	34.5 sq. mi.
Avg. Peak Flow:	58.08 cfs	23.64 cfs	36.9 cfs	173.3 cfs
Peak Flow Range:	4.8-172.0 cfs	0.2-55.0 cfs	2.5-90.0 cfs	51.0-342.0 cfs
Avg. Low Flow:	0.00 cfs	0.00 cfs	0.00 cfs	1.16 cfs
Avg. Overall Flow:	3.03 cfs	0.85 cfs	2.14 cfs	12.80 cfs
Avg. No. Flow Dates/Year:	278 days	130 days	192 days	365 days

Fish Creek exhibits similar seasonal variations in streamflow to Foidel Creek, although Fish Creek is perennial with an average base (low) flow of 3 cfs. Steele, et al (1977), postulates that most of this baseflow results from groundwater discharge into the stream: "During high flow, the groundwater contribution is a much smaller percentage of the streamflow and during low flow it probably accounts for nearly 100 percent of the streamflow at locations not affected appreciably by irrigation return flows." Boettcher (1972) estimates that 25 percent of the measured flow at gaging station 09244100 on Fish Creek results from groundwater discharge, and (Energy Fuels, 1979) ground water contribution is estimated to be 560 acre-feet per year. This year-round contribution dampers the seasonal variations in Fish Creek and the stream rarely freezes in winter due to the constant flow. The period of March through June is the season of the heaviest flow, when the combination of snowmelt, rainfall runoff, and groundwater discharge yield high runoff volumes in excess of 25 cfs (Energy Fuels, 1979).

Data from station 09244100 indicates that runoff yield is similar to Foidel Creek with about 60 acre-feet per year from the Fish Creek portion of the tract which is about 1,460 acres.

Two incised unnamed streams are ephemeral in their upper reaches (W $\frac{1}{2}$ Section 36, T. 6 N., R. 87 W.) above an altitude of about 7,100 feet. Below 7,100 feet they are spring-fed, and thus perennial throughout their remaining length. The southernmost spring flows about 20 gallons per minute (gpm) and has a dissolved solids content of about 1,100 milligrams per liter (mg/l). The other spring flows are about 25 gpm. and contain about 500 mg/l dissolved solids (Bureau, 1979).

Colorado-Yampa, which has expressed interest in the tract, owns a substantial supply of decreed surface water rights in Foidel Creek, both direct flow and storage 13.33 cfs and 153.21 acre-feet respectfully. Other surface water rights in the immediate area of the tract are summerized in Table 5-2. Most are for stockwater or irrigation usage. There are at least 15 stockponds on tract which provide seasonal water for livestock and wildlife.

Surface water is usually of good quality for livestock and wildlife with dissolved solids ranging from about 400 to 1,100 mg/l and pH range of about 7.1 to 8.2 dependent upon season and quantity of outflow. Surface water is predominantly calcium bicarbonate with lesser concentrations of magnesium and sulfate.

5.1.2 Groundwater

The tract lies on the western limb of the Twentymile Park Syncline in the southeastern part of the Yampa coalfield. Major aquifer units in the area consist of the Twentymile and Trout Creek Sandstones of the Williams Fork and Iles Formations respectfully. Wells finished in these thick, massive fine- to medium-grained sandstones can yield as much as 100 gpm (Brodgen and Giles, 1977), although sustained yields of such quantity are rare. Minor aquifers in the Williams Fork Formation include thin layers of fine-grained sandstone, siltstone, and, where locally fractured, coal beds (Energy Fuels, 1979) and generally yield an average of 10 gpm (Brogden and Giles, 1977).

Drilling programs and several years of mining at Energy Mine No. 2 have failed to encounter groundwater in the Fish Creek Coal Seam or overburden located above the

TABLE 5-2

WATER RIGHTS

NAME	LOCATION	AMOUNT
1. Energy pond #1	T4N, R86W, Sec. 7, SESE	3.1 ac-ft
2. Energy pond #6	T4N, R86W, Sec. 7, Lot 1	5.0 ac-ft
3. Papoulas spring and pipeline	T4N, R86W, Sec. 19, NESE	0.022 ac-ft
4. Eckman Park Ditch #1 and Reservoir #1	T4N, R87W, Sec. 13, SWNW	117.0 ac-ft
5. Eckman Park Ditch #2 and Reservoir #2	T4N, R87W, Sec. 13, NESE	12.2 ac-ft
6. Eckman Park Ditch #3 and Reservoir #3	T4N, R87W, Sec. 13, NESE	24.0 ac-ft
7. Ralenson Ditch	T5N, R87W, Sec. 25, SWSW	1.5 cfs
8. Southside Ditch	T5N, R87W, Sec. 35, NENW	0.5 cfs
9. Robert Perry	T5N, R87W, Sec. 36, NENW	Well Drilling Permit

Twentymile Sandstone of the Williams Fork Formation. Below the Twentymile Sandstone is approximately 500 feet of shale intermixed with minor beds of siltstone and sandstone. This stratigraphically and hydrologically separates the Twentymile Sandstone from the upper most economical coal bed, the Wadge.

The Wadge is underlying an interbedded sequence of predominantly fine-grained rocks consisting largely of shale and siltstone. This sequence is relatively impermeable. Comparatively thin sandstone beds immediately overlying the Wadge coal are moderately permeable, as is the thick sequence of sandstones underlying the Wadge down to and including the Trout Creek Sandstone. Virtually all domestic and stockwater wells penetrating this sequence obtain their water from sandstone beds below the Wadge coal. The Wadge coal itself is not sufficiently permeable in this area to be regarded as a potential aquifer (BLM, 1978). Wolf Creek coal bed is hydrologically and lithologically similar to the Wadge.

Minor aquifers in the interburden/overburden, when saturated, have an average permeability of 2.9 gallons per day per square foot, vertical leakance permeability of 0.1 gpd/ft^2 , storage coefficient of 1.7×10^{-9} and an average yield of 17.6 gpm (Energy Fuels, 1979).

Groundwater recharge to the aquifers in the Williams Fork and Iles Formations is thought to occur over the outcrop areas on the borders of the Twentymile Syncline structural basin (Bishop, et al, 1982). Also, these beds often are exposed in the sides of stream valleys out into the dipslope surface. Groundwater recharge, therefore, is limited to the narrow band where beds crop out along the steep backslope of the structure and to downward percolation on the dipslope surfaces (BLM, 1978).

From there, groundwater moves through the tract generally northwest in to the basin. Observation wells located near faults in Eckman Park by Energy Fuels indicate that the faults act as barriers to ground water flow, appear not to conduct water, and tend to hinder ground water flow toward the basin. The influence of faulting in the tract on groundwater flow is not known, but should only be minor because the faulting is parallel to the flow of the groundwater down dip.

It is important to note that in pre-mining condition, ground water from the area to be mined moves beneath and is hydraulically isolated from Foidel Creek by the impervious shale/siltstone below the Twentymile Sandstone. Bishop and Others (1982) hypothesized that Fish Creek receives groundwater discharge from aquifers draining the Eckman Park mining area. The extent of hydrologic connection between the Williams Fork Formation and Fish Creek is not known. Groundwater flowing down dip (northwest) from the western half of the tract should constitute limited recharge to Fish Creek, owing to over 200 feet of Lewis Shale between the Williams Fork Formation and Fish Creek. The Lewis Shale has limited vertical permeability, because it consists primarily of impervious shale and siltstone. Groundwater draining the eastern half of the tract may contribute to the flow of Fish Creek, since the Lewis Shale has been removed by erosion. In either case, plume model studies (Bishop and Others, 1982) conducted for the Energy Mines predicted that, in terms of time and distance, elevated TDS levels in spoil groundwaters flowing from the mines would be diluted to baseline levels prior to discharging to Fish Creek.

The amount of groundwater recharge is not known, but is probably less than one per cent of the annual 16 inch precipitation. Also, there is some recharge to the alluvium during periods of high discharge in Foidel Creek. This water, however, is

immediately released as the volume of runoff decreases. Direct recharge to deeper aquifers may occur where streams cross the northwest-southeast trending faults. Small stockponds within the tract probably do not contribute to recharge because of the high evaporation rates and silting of the pond bottoms (EMRIA Report No. 6, 1976).

Groundwater type is classified into three major groups: sodium bicarbonate waters, which occur in the lower part of the unconfined zones and in confined zones; calcium-magnesium sulfate waters, which occur in the thicker shales; and calcium bicarbonate waters, which occur mostly in the alluvium (EMRIA Report No. 6, 1976). Dissolved solids concentrations generally average 400 to 1,100 mg/l and decreasing by 25 percent or more below the Wadge coal bed, as sodium replaces calcium (BLM, 1978). Data for existing domestic and observation wells in and adjacent to the tract are presented in Table 5-3.

The water from one of the springs adjacent to the tract has been developed by W. L. Rogers for domestic and general use at the farm buildings near the northeast corner of the tract. Three springs are known to occur within the tract (5.1.1 and Table 5-2). Only one spring has been filed on and is located in T. 4 N., R. 86 W., Section 19, NE $\frac{1}{4}$ SE $\frac{1}{4}$.

5.1.3 Erosion and Sedimentation

Undisturbed portions of the tract are essentially stable and show very little erosion, probably less than 0.1 acre-feet per square mile per year (ac-ft/sq mi/yr). In contrast, cultivated areas show local rilling and moderate sediment

yield to the drainage net, which is essentially stable and shows little or no active channel erosion. Annual sediment yield from the overall tract is estimated to be about 0.15 to 0.20 ac-ft/yr.

Sedimentation ponds required by 30CFR: 816.42 to meet established effluent standards are expected to reduce sediment yield from the tract to a nonsignificant level.

5.1.4 Alluvial Valley Floors

The mainstream channel along Fish Creek contains portions of subirrigated alluvial fill on tract. Although these bottoms do not contain agricultural practices, they do provide limited grazing to livestock and wildlife, and are classified as Alluvial Valley Floors (AVF).

These areas along Fish Creek were not identified in the 1979 Williams Fork Management Framework Plan. Since that time and consultation with the State of Colorado, Fish Creek drainage has been classified as an AVF and will be protected from disturbances related to coal mining.

Delineation of the Fish Creek AVF, as can be determined with present information, is as follows: those areas in and paralleling the mainstream bottoms and those areas encompassing 300 feet adjacent to each bank of the mainstream channels, in Fish Creek in the NW¹/₄NW¹/₄NW¹/₄ of Section 36, and in Section 34 the entire length of Fish Creek in the southeast corner, T. 5 N., R. 87 W. The AVF within the tract will not be impacted by surface mining, since the proposed mine area is located

TABLE 5-3

DATA FOR WELLS AND SPRINGS ON AND ADJACENT TO THE FISH CREEK TRACT

No.	Location	Depth (feet)	Depth to Static Water Level (feet)	Aquifer	Specific Conductance (umhos/cm)	Dissolved Solids	pH	Date of Last Measurement	Use
1.	4-86-18BDA	180	70	KW <u>2/</u>	260	134	6.4	1/81	Observation
2.	4-86-19BBD	111	58	KW	850	506	7.1	7/81	Observation
3.	4-87-13AAD	200	+2 <u>1/</u>	KW	1,300	996	7.4	7/81	--
4.	4-87-13DAA	173	--	KW	1,200	855	7.4	7/81	Observation
5.	4-87-24BCB	145	43	KW	1,400	813	7.5	7/81	Observation
6.	4-87-24DBD	263	225	KW	1,243	833	7.2	11/77	Observation
7.	5-86-30CCC	350	--	KW	630	357	7.3	11/77	Domestic
8.	5-87-26DD	--	--	QAL <u>3/</u>	930	650	7.2	--	Domestic

1/ Flowing2/ KW-William Fork Formation3/ QAL Alluvium

about one and one-half miles east of the AVF (Map 2, this SSA). Surface runoff and groundwater flow from the proposed mine is to the north and northwest and does not intersect or recharge the AVF. The Wadge coal bed (stratigraphically the highest coal bed to be subsurface mined) is about 900 feet below the Fish Creek AVF and over 600 feet below the Twentymile Sandstone. The AVF should not be affected by subsurface mining by room and pillar methods using a 50% extraction rate (Section 3.2.2). Groundwater recharge to the AVF is most likely from shallow aquifers in the Upper Coal Group above the Twentymile Sandstone. Therefore, no impacts are expected to the water supply system in the AVFs on tract.

However, the impact of tract development on the water supply system to the AVF off tract is unknown. If additional information proves contrary to the previous statement, special performance standards found in 30CFR:822 would apply during mining activity.

5.1.5 Floodplains

The Williams Fork Management Framework Plan Coal Amendment, 1979, has identified one floodplain within the boundary of the tract unsuitable for disturbance related to mining. This is adjacent and parallel to Foidel Creek in section 7 and 18; T. 5 N., R. 86 W.

A floodplain is defined as any land area susceptible to being flood inundated from any source, including small and often dry water sources. Small watercourses can become sources of major flood damage runoff from intense rainstorms or rapidly melting snow.

Based on field examination estimated floor peak stage, lack of property, no threat to loss of life, and limited natural and beneficial uses of this floodplain, the drainage in Foidel Creek identified in the 1979 amendment as unsuitable, should be suitable for coal development.

Fish Creek, on the other hand, was not identified as a floodplain unsuitable for surface mining disturbance on tract. Because of the large watershed drainage area of Fish Creek, the Alluvial Valley Floors along its course, and the natural and beneficial uses of this floodplain, Fish Creek is determined unsuitable for surface disturbance related to coal development. The Fish Creek floodplain is not expected to be impacted by surface or subsurface mining within the tract and is discussed in Section 5.1.4, Alluvial Valley Floors.

Delineation of the Fish Creek floodplain, as can be determined with present information, is as follows: those areas inundated by the 100 year flood peak stage, in and paralleling the mainstream bottoms and those areas encompassing 300 feet adjacent to each bank of the mainstream channels, in Fish Creek in the NWNWNW corner of section 36, and in section 34 the entire length of Fish Creek in the southeast corner, T. 5 N., R. 87 W.

The following stipulation would apply to the above described area: No surface occupancy or surface disturbance related to mining activity. Therefore, no impacts are expected.

5.2 Environmental Consequences

5.2.1 Surface Water

Scenario 1 and 2

Impacts to the surface water system on tract as a result of mining are not expected to be significant. No appreciable reduction in runoff is expected to any of the drainages on tract provided that this water is not intercepted for use in mining operations and is diverted around the mining operation.

Surface flow distribution could be expected to be altered by changes in infiltration, interception, and evapo-transpiration because of surface mining.

Subsurface mining affects on the surface flow are expected to be almost non-existent because of lack of vertical communication of the strata overlying the Wadge coal bed.

Should subsidence occur, associated fracturing may increase the very limited communication between mined seams and the surface, but is not expected since subsidence should be a gentle lowering of the ground surface. Fractures associated with this type of subsidence should not be vertically extensive.

Water quality from surface mining operations is expected to change from a calcium bicarbonate type to a magnesium sulfate type: the sulfate ion would be less desirable as part of the total dissolved solid load, for stock water supply (Bishop et al, 1982), but should not be at such a concentration to be of significance to livestock or wildlife.

The Energy Fuels Corporation Salt Load Study (1980) considered the baseline contribution of salts to be 1.56×10^{-2} tons per acre. The increase in salt load above the baseline, detected below the Eckman Park Mine area, was considered to be contributed because of mining. The study showed an increase of 49 tons over baseline level or when attributed to the 275 acres of disturbed land results in an additional salt contribution of 1.18×10^{-1} tons per acre to South Foidel Creek. This evaluation took place during the period of April to September when flow occurs in Foidel Creek (Bishop et al, 1982).

Using the Eckman Park evaluation as a model for the tract, the increase in salt load from runoff to Fish Creek can be estimated. The disturbance of 200 acres for one year (Scenario 1) could result in an increase of 23.6 tons of salt to Fish Creek. Under Scenario 2, the salt load could increase by 7.9 tons per year to a maximum of 23.6 tons per year at the end of mine life (3 years) assuming no decreases in leaching rates because of salt depletion in the spoils with time. The TDS levels contributed to Fish Creek will decrease after completion of mining, perhaps in several years, because overland flow contacts the spoils in a very thin layer which is rapidly leached (McWhorter and Others, 1979, and Bishop and Others, 1982).

As many as 15 stockponds exist on tract but only one in the proposed surface mine area. This should present no problems if removed by mining because of the numerous stockponds remaining in the area.

All water rights in Table 5-2 should not be impacted from mining because either mining is not proposed in their immediate area or they are protected by Floodplains and Alluvial Valley Floors.

5.2.2 Groundwater

Scenario 1 and 2

Impacts to the aquifer system on tract are expected to be very minor.

As subsurface mining increases with depth between the northwest dipping Trout Creek Sandstone and the sandstones of the Williams Fork Formation, the amount of inflow to the mine shafts can be expected to increase. Increased inflow of water occurs because of increased bedrock saturation, increases of hydrostatic pressures with increasing depth mined relative to the lower pressure in the mine, and greater volume of aquifers intersected by mining.

The amount of this water, although expected to be low because of the low transmissivity of the Williams Fork Formation coal beds and sandstones, would be dependent upon the seams mined, the mining methods, communication with other water bearing strata, and fractures if subsidence occurs.

Inflow to surface pits is not expected because the Energy Fuels #2 Mine which is adjacent to the proposed tract has not encountered any water above the Twentymile Sandstone in their mining operations to date (Bishop et al, 1982).

The mined intervals on tract would be replaced by a mixture of spoils material, the permeability of which would depend primarily on the compaction resulting from the mining method. These replaced spoils are expected to be moderately permeable as a whole, with no relatively impermeable groundwater perching layers.

One domestic well, or at least water supply to that well, would be removed by mining in Section 36. This is not thought to be significant because the house in that area may be removed and there would be no need for water; and, if the house is not removed, water would be augmented by the lease.

The two springs identified in the affected environment occur on an adjacent coal tract previously leased and are expected to be removed when surface mining occurs on that tract (BLM, 1979). Therefore, mining operations on tract should have no bearing on these springs.

Other wells (Table 5.3) in the area should not be impacted by mining because of most of the wells are in alluvium or in shallow sandstone aquifers that should not be altered by surface mining, or subsurface mining because of the extreme distance (900 feet) of interburden separating the wells and the mineable subsurface coal seams.

The exact groundwater discharge into Fish Creek Basin from the tract is not known but within 5,000 to 7,000 feet of the spoil water source, the elevated TDS levels are expected to be diluted back to baseline levels before discharging into Fish Creek Basin (Bishop et al, 1982).

5.2.3 Irreversible and Irretrievable

Increased dissolved solids are expected in the spoils aquifer, but increases should be insignificant.

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THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1 and 2

Resource Element	Committed Mitigation	Anticipated				Impact EML	Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line	1992	1995	2000				
SURFACE WATER									
Type of Occurrence	All stream channels would be reconstructed to State and Federal regulations 30CFR:700	Fish Creek is perennial, Foidel is intermittent. Most tributaries to these are ephemeral	Most stream channels disturbed would be reconstructed and reconstructed.	Channels disturbed would be reconstructed and reconstructed.	Field observations and U.S. Geological Survey topographic maps.				
Quantity	Comply with State and Federal requirements.	Annual runoff to the Yampa River is about 0.5 inch or about 125 ac-ft/yr from the 2,860 acre tract.	Runoff to the Yampa River is not expected to be significantly reduced unless accepted for mining operations.	Annual runoff should return to near pre-mining conditions after reclamation with area and from flow possibly being extended into Foidel Creek through July or into Aug.	Effects of development on surface water are largely inferred from mining operations in the area and from reclamation in the area and from flow possibly being extended into Foidel Creek through July or into Aug.				Minor decrease in surface runoff is expected because of increased permeability of spoils aquifer and possible occurrence of subsidence.

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1 and 2

Resource Element	Committed Mitigation	Anticipated				Impact EML	Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line	1992	1995	2000				
SURFACE WATER									
Quality	Comply with State and Federal requirements.	Water in streams and ponds indicates that runoff continues 400 to 1,100 mg/l dissolved solids with a pH of 7.1 to 8.2.	Slight increase in dissolved solids due to mining operations.			Leaching of spoils after reclamation could increase dissolved solids by as much as 1,500 mg/l.	Inferred from references in text.		Increased dissolved solids could be expected from spoils aquifer. Springs may appear at lower elevations of the reclaimed area.
Salinity of Receiving Waters (Yampa River)	Comply with State and Federal Water Quality Standards and NPDES Permit.	No current salinity problems in the Yampa River.	Slight increase is expected due to population and use in mining operations.		Up to 41 tons per year may be expected. Although effects are expected to be short term.		Inferred from Energy Fuels Corporation Salt Load Study (1980)		Effects should be short term (McWhorter, et al, 1979). Increased salinity should show no significant impact on aquatic biology down stream.
Erosion and Sediment Action	Comply with State and Federal Requirements 30CFR: 816.42	Undisturbed portions of the tract are stable. Cultivated areas show local rilling and moderate sediment yield. Overall	Sedimentation ponds would reduce sediment yield to a non-significant level.		Insufficient long term sediment yield. Upon completion of reclamation yield should be no more than pre-		Inferred from previous mining operations in area and prior site specific analysis.	None	

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1 and 2

Resource Element	Committed Mitigation	Base Line	Anticipated 1992	Impact 2000 EML	Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
<u>SURFACE WATER</u>							
Importance to Industry (Agriculture)	Augmentation plan submitted to the State of Colorado by the mining company.	Runoff in Fish Creek is expected be allocated for cause use is irrigation. Runoff to Foidel Creek plan. is allocated to irrigation and Colorado mining operations	No change is expected be-cause use is mitigated in augmentation plan.		Field observa-tions and U.S. Geological Sur-vey topographic maps and water rights filings.	None	
Importance to Livestock and Wildlife.	Augmentation plan submitted to the State of Colorado by the mining company.	At least 15 stockpounds on tract	Planned sur-face mining should only remove one reservoir. Ponds in area should pro-vide alter-nate source.		Field observa-tions U.S. Geological survey topo-graphic maps and water rights filings.	None	Stockpond could be recon-structed at end of mining.
Importance to People	Augmentation plan submitted to the State of Colorado by the mining company.	No surface runoff is al-located for domestic use. One spring provides water for domestic use in section 36 T6N,R87W. See Text 5.22	Augmentation plan would require re- placement of any inter- rupted supply to spring for domestic use if house is not removed by mining		Field observa-tions U.S. Geological survey topo-graphic maps and water rights filings.	None	

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1 and 2

Resource Element	Committed Mitigation	Base Line	Anticipated			Impact EML	Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
			1992	1995	2000				
<u>SURFACE WATER</u>									
Alluvial Valley Floors	PL 97-85 Surface Mining and Reclamation Act 1977.	Fish Creek in section 34 and 36, T6N, R87W. See text 5.1.4 Alluvial Valley Floors	None				Field observations, U.S. Geological survey topographic maps.	None	
Floodplains and Wetlands	Federal Land Policy Management Act--BLM E.O. 11998	Two Floodplains have been identified on tract in Foidel and Fish Creeks; see text 5.1.5 Floodplains.	None				Field observations, U.S. Geological survey topographic maps. Colorado water Conservation Board Technical Manual No. 1, 1976; Williams Fork Management Framework Plan Coal Amendment 1979	None	

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1 and 2

Resource Element	Committed Mitigation	Anticipated			Impact EML	Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line	1992	1995				
GROUND WATER								
Type of Occurrence (Aquifers)		Major aquifers on tract are the Twenty-mile and the Trout Creek Minor inter-bedded sandstones of the Williams Fork Formation.	Minor affects to the aquifer system are expected. Because of low recharge in the area and limited use of these formations in the general area as aquifers.		Altered aquifer system on tract, and numerous increased infiltration into spoils aquifer and greater	Inferred from Geology of tract and numerous sited references in the text.		During life span of the mining operation periodic declines in quantity and quality can be expected.
Quantity	Comply with State and Federal Regulations.	Yields from aquifer in bedrock are low, about 10 gpm. Two wells on tract, one domestic, one observation.	Domestic well is expected to be removed by surface mining. Yields in both spoils aquifer are expected to increase slightly.		New springs are expected to appear at lower elevations from surface mining. Discharge from subsurface is expected flow into Fish Creek Basin.	Inferred from Geology of tract and numerous sited references in the text.		Aquifer system on tract would be altered. Yields are expected to increase in spoils aquifer both from surface and subsurface mining.

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1 and 2

Resource Element	Committed Mitigation	Base Line	Anticipated 1992	Impact 2000 EML	Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
GROUNDWATER							
Quality	Comply with State and Federal Regulation.	Water in bed-rock aquifers are 400 to 1,100 mg/l dissolved solids and are mainly of spoils piles.	Slight increase in dissolved solids from mining disturbance and spoils piles.	Leaching of spoils aquifer may increase dissolved solids by as much as 1,500 mg/l.	Inferred from references in the spoils text.	Increased dissolved solids are expected in the spoils aquifer. Insignificant impact.	
Importance to Wildlife and Livestock.	Augmentation plan submitted to the State of Colorado by the mining company.	No ground water is located on the tract for livestock or wildlife but one spring supplies water. See Text 5.2.2	None	New springs may appear at lower elevations of spoils aquifer.	Field observations and water rights filings.		Numerous ponds would supply needed water in the area.
Importance to Industry	Augmentation plan submitted to the State of Colorado by the mining company	Groundwater is not located on the tract or immediately adjacent to the tract.	None		Field observations and water rights filings.	None	

6 Vegetation

6.1 Affected Environment

The vegetation of the tract consists of a number of different range sites. A range site is defined as a type of rangeland with inherently different soil characteristics that produce a significantly different kind or amount of potential vegetation. A discussion of each of these follows. See Figure 6-1 for rangesite map. Composition and production estimates are expressed on a dry weight basis.

The "mountain loam" site occupies slopes, terraces and valleys. Slopes average between 5 and 10%, but can reach 30 to 40%. The soils are fairly deep, and have a good water holding capacity. A large percent of the soil moisture is available for plant growth. The plant composition of the site is 20% grasses, 5% forbs, and 75% shrubs. The principal grasses are Poa sandbergii (sandberg-bluegrass) and Agropyron smithii (western wheatgrass). The major forbs are Achillea lanulosa (western yarrow), Eriogonum sp. (buckwheat) and Balsamorhiza saggitata (arrowleaf balsamroot). The dominant shrub is Artemisia tridentata (big sagebrush). Other shrubs present are Symphoricarpos sp. (snowberry) and Amelanchier sp. (serviceberry). There are periodic inclusions of Quercus gambellii (Gambel's oak) and Populus tremuloides (aspen) on the site. The estimated total annual production ranges from 1,000 to 1,500 pounds per acre . The site is in good ecological condition, and displays light to moderate utilization. The mountain loam range site is 896.09 acres of the tract, or 31 percent.



The "brushy loam" site occupies gently rolling to steep upland slopes. The degree of slope ranges from 3 to 65%. The soils are dark sandy loams to light clay loams. It is moderately permeable and favorable to plant growth. The plant composition of the site ranges from 15 to 50% grasses, 10 to 15% forbs, and 40 to 70% shrubs. The major grasses are Poa pratensis (Kentucky bluegrass), Stipa comata (needle and thread) and western wheatgrass. The principal forbs are Vicia americana (American vetch), Lupinus sp. (lupine), western yarrow, Castilleja sp. (Indian paintbrush) and buckwheat. The dominant shrubs are big sagebrush, Purshia tridentata (antelope bitterbrush), Gambel's oak and serviceberry. The estimated total annual production ranges from approximately 1,100 to 1,300 pounds per acre. The site appears to be in good ecological condition, and displays moderate to heavy utilization. The brushy loam site consists of 591.41 acres, or 21 percent of the tract.

The "mountain meadow" site occurs in mountain valleys, swales and in open parks. The soils are moderately deep, dark, highly organic, and poorly drained. The soil moisture is plentiful throughout the growing season in most places. The soil may become dry on the surface in spots in late summer and fall. The mountain meadow is generally a grass/sedge community, with a variety of forbs. The plant composition of the site is 75% grasses, 10% forbs, and 15% shrubs. The principal grasses are Deschampsia caespitosa (tufted hairgrass), Carex sp. (sedge), Poa sp. (bluegrass), and Stipa sp. (needlegrass). The major forbs are Iris missouriensis (blue flag), Trifolium sp. (clover), Senecio sp. (groundsel), and western yarrow. The dominant shrub present on the site is Artemisia cana (silver sage). The estimated total annual production is 2,000

pounds per acre. The site is in good ecological condition. The mountain meadow consists of 135.12 acres, or 5% of the tract.

The "claypan" site occupies nearly level to fairly steep slopes. The subsoil is strongly structured and fine textured. The clays restrict water permeability and plant-moisture availability. The plant composition of the site is 40 to 65% grasses, 5 to 10% forbs, and 25 to 55% shrubs. The major grasses are western wheatgrass, needlegrass, and bluegrass. The principal forbs present are western yarrow, balsamroot, and lupine. The dominant shrubs are silversage and big sagebrush. The estimated total annual production ranges from 500 to 1,000 pounds per acre. The condition of the site is in fair ecological condition, and displays slight utilization. The claypan consists of 427.45 acres, or 15% of the tract.

The "loamy slopes" site occurs on moderate stony slopes. The soils are stone-filled sandy loams to light clay loams. The permeability is moderate. This is generally a browse-grass plant community. The plant composition of the site is 55% shrubs, 35% grasses and 10% forbs. The dominant shrubs of this site are big sagebrush, serviceberry and bitterbrush. The principal grasses are the wheatgrasses and Indian ricegrass. The major forbs are balsamroot and buckwheat. The estimated annual production is about 900 pounds per acre. The loamy slopes consist of 11.33 acres or 1% of the tract.

There is a disturbed area on the tract, which is 35.67 acres, or 1% of the tract. This area is due to existing mining activities. North of the disturbed area is 107.44 acres of land presently being reclaimed. It is 3.6% of the tract.

The remaining 527.25 acres, or 18.4%, is agricultural land. The major crop in the area is dryland wheat under a two-year rotation system.. The yields range from approximately 12-15 bushels per acre in a poor year, to as much as 40 bushels per acre in a good year. The dryland wheat produces about 26 bushels per acre in an average year. This is approximately 13,708 bushels on 527.25 acres.

6.1.1 Threatened, Endangered and Sensitive Plants

A field survey was conducted by the Bureau of Land Management in 1982. No known threatened, endangered or sensitive plants were found.

6.2 Environmental Consequences

6.2.1 Vegetation

There would be a temporary loss of the native vegetation in both scenario 1 and scenario 2. This vegetation loss, from disturbance, of 225 acres and 300 acres, respectively, is not a significant impact because of post mining reclamation regulations. When the use of the vegetation and the farmland is considered, there could be a significant impact, see section 13, Land Use.

6.2.2 Short Term vs. Long Term Productivity

In both scenarios 1 and 2, the short term loss of the native vegetation and farmland would not significantly impact the long term productivity of the area,

as post mining regulations require reclamation, however, species diversity would remain somewhat altered following reclamation.

6.2.3 Irreversible/Irretrievable

Species diversity would be altered. This is not considered significant.

6.2.4 Threatened, Endangered and Sensitive Plants

As there were no threatened or endangered plants found on the tract, there would be no impact from mining to these species.

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1

Resource Element	Committed Mitigation	Anticipated			Impact		Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context)
		Base Line	1992	1995	2000	EML			
<u>Vegetation</u>									
		<u>Acres</u>							
Mountain Loam		896.09	0	0	0	0	Fair		The temporary loss of 72 acres of the native vegetation is not significant due to post mining reclamation regulations.
Brush Loam		591.41	67	67	67	67			
Mountain Meado		135.12	0	0	0	0			
Claypan		427.45	5	5	5	5			
Loamy Slopes		11.33	0	0	0	0			
Aspen		125.24	0	0	0	0			
Disturbed Land		35.67	0	0	0	0			
Agriculture (Wheat)		527.25	153	153	153	153			The temporary loss of 153 acres of wheat is not significant.
Reclaimed Land		107.44	0	0	0	0			

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 2

Resource Element	Committed Mitigation	Anticipated			Impact		Data Reliability	Irreversible & Irrecoverable Commitments (Proposed Mitigation)	Comments (Context)
		Base Line	1992	1995	2000	EML			
<u>Vegetation</u>									
		Acres							
Mountain Loam		896.09	16.83	51.0	51.0	51.0	Fair		The temporary loss of 129 acres of the native vegetation is not significant due to post mining reclamation regulations.
Brushy Loam		591.41	22.11	67.0	67.0	67.0			
Mountain Meadow		135.12	0	0	0	0			
Claypan		427.45	3.63	11.0	11.0	11.0			
Loamy Slopes		11.33	0	0	0	0			
Aspen		125.24	0	0	0	0			
Disturbed Land		35.67	0	0	0	0			
Agriculture (Wheat)		527.25	56.43	171.0	171.0	171.0			There would be a temporary loss of about 171 acres of wheat, which is not significant.
Reclaimed Land		107.44	0	0	0	0			

7 Wildlife

7.1 Affected Environment

7.1.1 Wildlife Habitat

Terrestrial habitats on this 2,857 acre tract consist of aspen - 4% (125 acres), mountain shrub - 21% (603 acres), sagebrush - 33% (937 acres), grassland - 20% (563 acres), and cropland - 18% (527 acres). The first four types provide needed food and cover to sustain big game in winter, and provide for upland game bird survival. Cliffs occur within these types and are important raptor nesting sites.

Descriptions of these habitat types are included in the Green River-Hams Fork final EIS. Table 7-1 correlates these types with the range sites used in the Vegetation Section of this report.

One type, riparian, not used in the Vegetation Section will be discussed here. Comprising less than one percent of the tract total, it occurs as scattered clumps of willow, grasslike areas of sedges and rushes, and small marshes with emergent vegetation. This water associated type is found along Fish and Foidel Creeks and their tributaries. The exact acreage is unknown.

Aquatic habitat occurs in Fish and Foidel Creeks and ponds formed in intermittent tributaries of Foidel Creek. These provide water sources for terrestrial wildlife, and living space for aquatic animals. A fisheries is known to occur only in Fish Creek (3/4 mile on tract). The exact acreage of this type is not known, but a minimum of four (4) miles of riparian habitat occur on tract.

TABLE 7-1

RELATIONSHIP OF HABITAT TYPES TO VEGETATION SECTION RANGE SITES

Terrestrial Habitat Type	Name	<u>Range Site</u> Code Letter
Aspen	Aspen	F
Mountain Shrub	Brushy Loam	B
	Loamy Slopes	E
Sagebrush	Disturbed Land	G
	Mountain Loam	A
Grassland	Claypan	D
	Mountain Meadow	C
Cropland	Agricultural (Wheat)	H

7.1.2 Animal Populations

Table 7-2 summarizes the occurrence and density of key wildlife species on this tract. Key use areas are shown in Figure 7-1.

Mule deer and elk are the major big game species inhabiting the tract. Mule deer occur year-round. The tract provides good summer range with moderate deer numbers occurring at this time. Portions of the tract are critical winter range. The remainder is winter range. An estimated minimum of 213 deer would occur in winter. This is calculated using the 10-year average winter density for Data Analysis Unit (DAU) D-7 (Colorado Division of Wildlife, February 11, 1980 letter).

Elk calving occurs near the tract. The entire tract is elk winter range. An estimated 65 elk would use the tract in winter. This is calculated from the DAU E-7 10-year average on winter ranges (CDOW, February 11, 1980 letter). An on-going elk study is being conducted in the Colorado-Yampa mine area which encompasses this tract. It is designed to provide data on the importance of the local elk calving

FIGURE 7-1
KEY WILDLIFE USE AREAS ON THE
FISH CREEK COAL TRACT

Legend:

- MULE DEER: CRITICAL WINTER RANGE (dotted pattern)
- MULE DEER: WINTER RANGE (vertical line pattern)
- ELK WINTER RANGE-ALL (horizontal line pattern)
- GOLDEN EAGLE NEST (star symbol)

SCALE: 1:24,000

Map features include: Fish Creek, Foidel Trail, Jeep Trail, R 86, R 87 W, T 4 N, T 5 N, and various contour lines and grid numbers.

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area to herd survival. Preliminary results indicate adjacent calving areas are available, if elk were displaced. Final conclusions will not be available until the study is completed.

TABLE 7-2

KEY WILDLIFE OCCURRENCE AND DENSITY

Species Present	Density (Number/Square Mile) Winter
Mule Deer	47.4 <u>/1</u>
Elk	14.5 <u>/1</u>
Sage Grouse	.7 <u>/1</u>
Sharp-tailed Grouse	Unknown
Blue Grouse	.7
Ducks	Unknown, but probably low
Golden Eagle	At least one pair <u>/2</u>
Fish	Unknown

/1 These densities are being revised by Colorado Division of Wildlife. If significant changes occur, the revised numbers will be used in the decision-making process regarding leasing and mitigation.

/2 Total known tract population--not a density.

Sage grouse, blue grouse, and sharp-tailed grouse occur on tract. Populations densities of sage and blue grouse are low to moderate. No reproduction areas for sage grouse(strutting grounds) are known to occur. An estimated minimum three sage grouse and three blue grouse inhabit the tract. These estimates are probably low, since they are based on old data (CDOW 1041 data, 1974).

Sharp-tailed grouse numbers and use areas are unknown. Further study would be needed to determine the importance of this tract to the sharp-tailed grouse population in the area. One old dancing ground in section 36 no longer occurs (J. Hicks, CDOW).

Ducks feed, rest, and nest in Fish and Foidel Creeks. Exact population numbers are not known, but are probably high enough to be locally important.

Golden eagles nest on and near the tract. Three nests are known with a minimum of one breeding pair using the tract.

Trout occur in Fish Creek. Data on species occurrence and population size is unknown.

7.1.3 Threatened and Endangered Animals

No T/E species or critical habitat is known to occur.

7.1.4 Wild Horses

None occur.

7.1.5 Land Use Planning Stipulations

The Williams Fork Management Framework Plan Coal Amendment 1979 provides for mitigation of losses of certain key wildlife species habitats when they result from

surface mining and subsurface mining facilities. The following stipulation would apply to the disturbed area of this tract:

"The lessee shall be required to mitigate for mule deer, elk, and sharp-tailed and sage grouse habitat loss and the resultant loss or displacement of this species, as a key indicator species, due to coal mining operations. The lessee shall be required to submit for approval to the Authorized Officer a habitat recovery and replacement plan for protection or enhancement of the deer, elk, and sharp-tailed and sage grouse populations affected by habitat loss or displacement from historic habitat.

The habitat recovery and replacement plan shall be developed in consultation with the Authorized Officer and the Colorado Division of Wildlife (CDOW) based on estimates of lost and disturbed habitat as described in this document. If the mine plan submitted by the lessee indicates figures different from the lost habitat estimates used in this document as to quality and quantity of habitat lost or disturbed, mitigation alternatives shall be recalculated based upon revised data contained in the mine plan.

The final habitat recovery and replacement plan shall indicate the methods to be employed by the lessee which will ensure that the carrying capacity of the recovered or replaced land has the capacity to support this indicator species as agreed upon by the Authorized Officer and CDOW.

Mitigation methods may require the lessee to employ techniques for wildlife range manipulation or intensive wildlife range management. Habitat recovery may not be completely feasible in the permit area; therefore, recovery or replacement may be

accomplished on lands made available through the surface management agency, the state, or the lessee outside the permit area in combination with recovery and replacement methods on suitable lands within the permit area.

The habitat recovery and replacement plan shall include the following:

1. A habitat analysis of the permit area which:
 - a. identifies the above species which occupy the permit area, and
 - b. includes an analysis of the quality or carrying capacity of the habitat or this species.
2. A detailed description of the methods selected by the lessee to mitigate habitat loss, together with a comparative analysis of alternate methods which were considered and rejected by the lessee and the rationale for the decision to select the proposed methods.

The methods utilized by the lessee for recovery and replacement may include, but are not limited to, the following techniques:

- a. Increasing the quantity and quality of forage available to wildlife.
- b. The acquisition of critical wildlife habitats.
- c. Mechanical manipulation of low quality wildlife habitat to increase its carrying capacity for selected wildlife species.
- d. Recovery, replacement or protection of important wildlife habitat by selected fencing.

3. A timetable giving the periods of time which will be required to accomplish the habitat recovery or replacement plan and showing how this timetable relates to the overall mining plan.

4. An evaluation of the final plan by CDOW. The CDOW shall comment on the methods selected and the techniques to be employed by the lessee and may recommend alternate recovery or replacement methods. If the CDOW has recommended an alternate method, the lessee shall consider the CDOW's recommendation and, if the lessee rejects the CDOW's plan, the lessee shall indicate its reasons as required by provision 2 above. If no CDOW comment is included in the plan, the lessee shall verify its consultation with the CDOW, and the plan may be considered without CDOW comment."

Buffer zones to protect three golden eagle nests in sections 7, 12, 13 and 18 have been delineated and declared unsuitable for surface mining and subsurface facilities in the 1982 MFP Update (Figure 7-2).

The following areas are recommended as unsuitable for surface coal mining in order to protect golden eagle nests:

Nest Location

T. 4 N., R. 87 W.
Sec. 12

Buffer Zone

T. 4 N., R. 87 W.
Sec. 12: SE $\frac{1}{4}$, SE $\frac{1}{4}$ NE $\frac{1}{4}$
Sec. 13: N $\frac{1}{2}$ NE $\frac{1}{4}$

T. 4 N., R. 86 W.
Sec. 7: Lots 7, 8, 13, 14
Sec. 18: Lot 4

The following stipulation applies to the lands described above: No. surface occupancy or disturbance, between February 1 and July 31, annually.

A committed buffer zone to protect a sharp-tailed grouse dancing ground occurs in section 36 N $\frac{1}{2}$, T.5 N., R. 87 W (1979 Williams Fork MFD Supplement). This dancing ground no longer exists (J. Hicks, CDOW). Therefore, this land has been determined suitable for coal development and associated surface disturbing activities.

7.2 Environmental Consequences

7.2.1 Wildlife Habitat

Mining and associated disturbance would remove 225 acres (Scenario 1) or 300 acres (Scenario 2) of terrestrial habitats from wildlife production. The mountain shrub, sagebrush, and grassland types provide important food and cover for big game and upland game birds, and nest site for raptors. An estimated 72 acres (Scenario 1) or 129 acres (Scenario 2) of these habitats would be disturbed. The balance of disturbance would occur in cropland that is of minimal value to wildlife.

Loss of the 25 or 129 acres would displace the mule deer, elk, and sage and sharp-tailed grouse that are presently dependent upon this area for food and cover. With committed mitigation (Section 7.1.5) the loss of deer, elk, and sharp-tailed and sage grouse habitats would not significantly reduce area

populations. Adjacent habitats exist to support these displaced animals, with the committed mitigation, 7.1.5,, as well as blue grouse which would not require mitigation.

Riparian and aquatic habitats along Fish and Foidel Creeks would not be mined. Therefore, no significant adverse impacts would occur.

7.2.2 Animal Populations

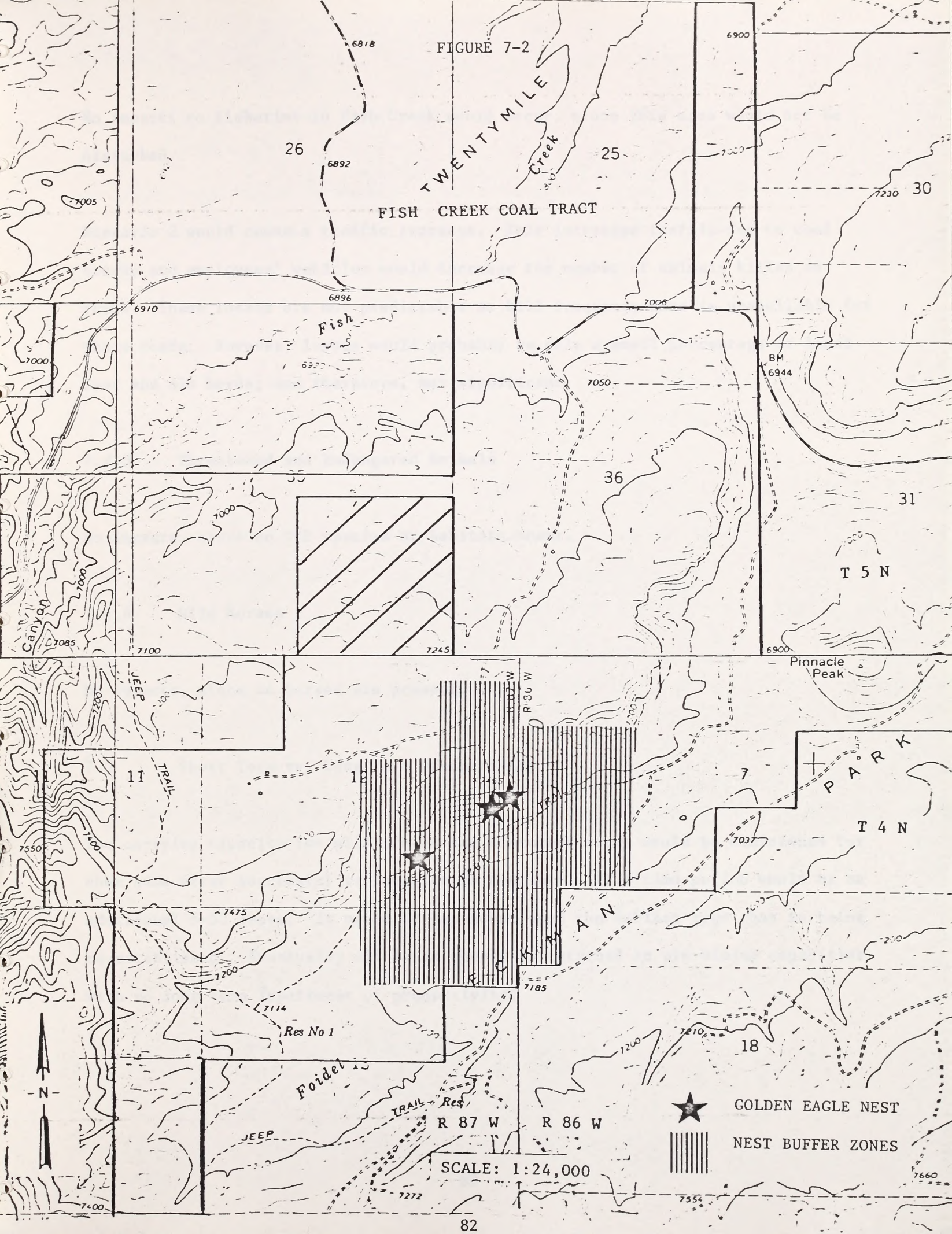
Depending upon the Scenario analyzed (1 or 2), an estimated 17 or 22 mule deer, 5 or 7 elk, no sage grouse, no blue grouse, and an unknown number of sharp-tailed grouse would be displaced by habitat destruction by end of mine life. Adjacent habitats to support deer, elk, and sharp-tailed and sage grouse at present levels are available, if committed mitigation is implemented to increase their carrying capacity. With this mitigation population losses would be reduced to an acceptable level.

Adverse impacts to blue grouse would be minimal. Only a small portion of available blue grouse habitat would be disturbed, thus impacting few birds.

Populations in Routt County are generally low, and concern for this species exists. Further data is needed regarding their occurrence and numbers on-tract before assessment of impacts can be made.

Impacts to golden eagles would be minimal as buffer zones established as committed mitigation adequately protect the existing nest sites (7.1.5) (Figure 7-2).

FIGURE 7-2



FISH CREEK COAL TRACT

Fish

T 5 N

Pinnacle Peak

T 4 N

GOLDEN EAGLE NEST

NEST BUFFER ZONES

SCALE: 1:24,000

No impacts to fisheries in Fish Creek would occur, since this area would not be disturbed.

Scenario 2 would cause a traffic increase. This increased traffic due to coal trucks and employees' vehicles would increase the number of animals killed on roads. These losses are not predictable as kill frequency data is unavailable for these roads. However, losses would probably be only a small percentage of local deer and elk herds; and therefore, not significant.

7.2.3 Threatened and Endangered Animals

No impacts, since no T/E species or habitats occur.

7.2.4 Wild Horses

No impacts, since no horses are present.

7.3 Short Term vs. Long Term Productivity

The carrying capacity for wildlife on the disturbed sites would be diminished for some time after successful reclamation is complete. This time period would be an additional 5-50 years. It would be dependent upon the habitat type that is being re-established. Eventually all lands should be returned to pre-mining capacities with no long term impairment of productivity.

7.4 Consultation and Coordination

The golden eagle buffer zones were established in consultation with U.S. Fish and Wildlife Service (letter received October 26, 1981). Informal consultation for T/E species was completed for the 1982 MFP Update (October 26, 1981).

Informal consultation for State T/E and State species of concern was completed for the 1982 MFP Update (letters dated October 26, 1981, and November 3, 1981).

Discussion regarding the sharp-tailed grouse dancing ground in N $\frac{1}{2}$ section 36 was conducted by phone with J. Hicks, CDOW.

Formal consultation with Fish and Wildlife Service and Colorado Division of Wildlife has been initialed.

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1

Resource Element	Committed Mitigation	Anticipated			Impact		Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line	1992	1995	2000	EML			
Habitats (Acres)									
Aspen	Reclamation Regs	125	0	0	0	0	Good	None	Not significant with mitigation
Mt. Shrub	"	603	67	67	67	67	"	"	"
Sagebrush	"	937	0	0	0	0	"	"	"
Grassland	"	563	5	5	5	5	"	"	"
Cropland	"	527	153	153	153	153	"	"	Not important wildlife habitat
Riparian	"	4 miles	0	0	0	0	Acceptable	"	"
Aquatic	"	3/4 Mile	0	0	0	0	"	"	"
Populations									
Mule Deer	Stipulation	213	17	17	17	17	Acceptable	None	Not significant with mitigation
Elk	"	65	5	5	5	5	"	"	"
Sage Grouse	"	3	0	0	0	0	"	"	"
Blue Grouse	N/A	3	0	0	0	0	"	"	"
Sharp-tailed Grouse	None	Unknown	0	0	0	0	Unsatisfactory	"	Not significant with mitigation.
Ducks	N/A	Unknown	0	0	0	0	Acceptable	None	"
Golden Eagle	Buffer Zone	3 Nests	0	0	0	0	Good	None	"
T/E	N/A	None							
Wild Horses	N/A	None							
Fisheries	N/A	Unknown	0	0	0	0			

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 2

Resource Element	Committed Mitigation	Base Line	Anticipated			Impact	Data Reliability		Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		1992	1995	2000	EML					
Habitats (Acres)										
Aspen	Reclamation Regs	125	0	0	0	Good		None		Not significant with mitigation.
Mt. Shrub	"	603	16.83	51	51	"		"		"
Sagebrush	"	937	22.11	67	67	"		"		"
Grassland	"	563	3.63	11	11	"		"		"
Cropland	"	527	56.43	171	171	"		"		Not important wildlife habitat.
Riparian	"	Unknown	Unknown	Unk	Unk	Acceptable		"		"
Aquatic	"	4 Miles	0	0	0	"		"		"
Populations										
Mule Deer	Stipulation	213	22	22	22	Acceptable		None		Not significant with mitigation.
Elk	"	65	7	7	7	"		"		"
Sage Grouse	"	3	0	0	0	"		"		"
Blue Grouse	"	3	0	0	0	"		"		"
Sharp-tailed Grouse	None	Unknown	Unknown	Unk	Unk	Unsatisfactory		Unknown		Not assessable.
Ducks	N/A	Unknown	0	0	0	Acceptable		None		"
Golden Eagle	Buffer Zone	3 Nests	0	0	0	Good		"		"
T/E	N/A	None								
Wild Horses	N/A	None								
Fisheries	N/A	Unknown	0	0	0					

8 Recreation Resources

8.1 Affected Environment

There are no public lands within the tract. However the Williams Fork MFP identifies recreation opportunities for hunting, wildlife observation, scenic viewing and environmental interpretation values in the area encompassing Fish Creek Canyon and the western portion of the tract. Any use, which would be by permission of landowners, is estimated to be low.

There are no recreation developments in or adjacent to the tract. There is no current recreation data.

8.2 Environment Consequences

Scenario 1 and 2

The dispersed recreation opportunities existing on tract are available elsewhere in similar settings. Sights and sounds from existing mining operations adjacent to the tract have diminished the quality of the environment in most of the area. There are no present or future plans to develop the recreation potential of the area. Recreation is expected to increase in proportion to population growth with or without the proposed coal lease. There would be no significant impact with no change in population under Scenario 1. It is anticipated that no significant impact would occur under Scenario 2 . The new

population would also be divided between Hayden, Steamboat Springs, Milner, Oak Creek, Yampa, and Phippsburg. The smaller communities would have a more difficult time accommodating increased recreation demands.

8.2.1 Short Term vs. Long Term

All recreation opportunities would be lost on tract in the short term (mine life) which is insignificant. No significant impact to urban recreation is expected if the communities receiving population growth under Scenario 2 are able to accommodate or develop new facilities to meet recreation demands.

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1 & 2

Resource Element	Committed Mitigation	Baseline	Anticipated 1992	Impact 1995	Impact 2000	EML	Data Reliability	Irreversible & Irrecoverable Commitments	Comments (Context) Proposed
<u>Recreation</u>									
ACEC		None					No recreation data.		Incomplete planning.
Wilderness		None					Good		
Wild & Scenic Rivers		None					Good		
Land Use Planning Stipulations		None					No current recreation data.		
Proposed Mitigation		None							
Values on tract		Hunting Observa-tion.	All opportunities lost.						
								Hunting wildlife observation.	

9 Visual Resources

9.1 Affected Environment

VRM Class III and IV apply to the tract. The Class III area, northern portion of the tract, has high visual sensitivity falling into the foreground/middle ground distance zone as viewed from Routt County road 27. The Class IV area has medium visual sensitivity and is in the seldom seen distance zone. Scenic quality on the tract is rated C (low).

The area has vegetative and topographic variety which is common throughout the vicinity. Fish Creek Canyon is scenic and rates B (average) scenic quality and medium visual sensitivity because Routt County road 37 through the canyon receives a moderate amount of traffic. Views are extensive to the north from high points on the tract.

Coal mining operations to the north, east, and on the tract detracts from the aesthetic value of the overall natural, undeveloped character of the environment.

9.2 Environmental Consequences

Scenario 1 and 2

Surface mining would cause an alteration to the undeveloped landscape and would not meet the VRM Class III or IV objectives. The disturbed areas, 225 to 300 acres, would be lowered to Class V, interim management, until after successful

reclamation. These impacts are not considered significant because reclamation regulations require returning the land mass to a natural appearing topography.

9.2.1 Short Term vs. Long Term

It would take 20-50 years after successful reclamation to establish original vegetative types. In the long term the mined area would feasibly be returned to its original VRM classification. No significant impact would occur.

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1 and 2

Resource Element	Committed Mitigation	Anticipated			Impact		Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line	1992	1995	2000	EML			
Visual Resources									
Scenario 1 Class	OSM reclama- tion regs.	III IV	225 acres	225 acres	225 acres	225 acres	Good		Impact is lowering of Class III and to Class V. It would require 20-50 years after suc- cessful reclamation to reestablish the original VRM classes. No significant impact due to reclamation regulations.
Scenario 2 Class	OSM reclama- tion regs.	III IV	100 acres	300 acres	300 acres	300 acres	Good		
Land Use Planning Stipulations		None							
Proposed Mitigation		None							

10 Cultural Resources

10.1 Affected Environment

Within this coal tract approximately 1,577 acres have been surveyed at a Class III level (100% intensive full inventory; see Bureau of Land Management Manual, 8111.14) as shown in Figure 10-1. The efficiency of a Class III survey depends on topography, vegetation cover, and past historic land use at any particular site. These factors influence the potential of finding hidden and subsurface sites, which remain undetected and therefore would be unprotected.

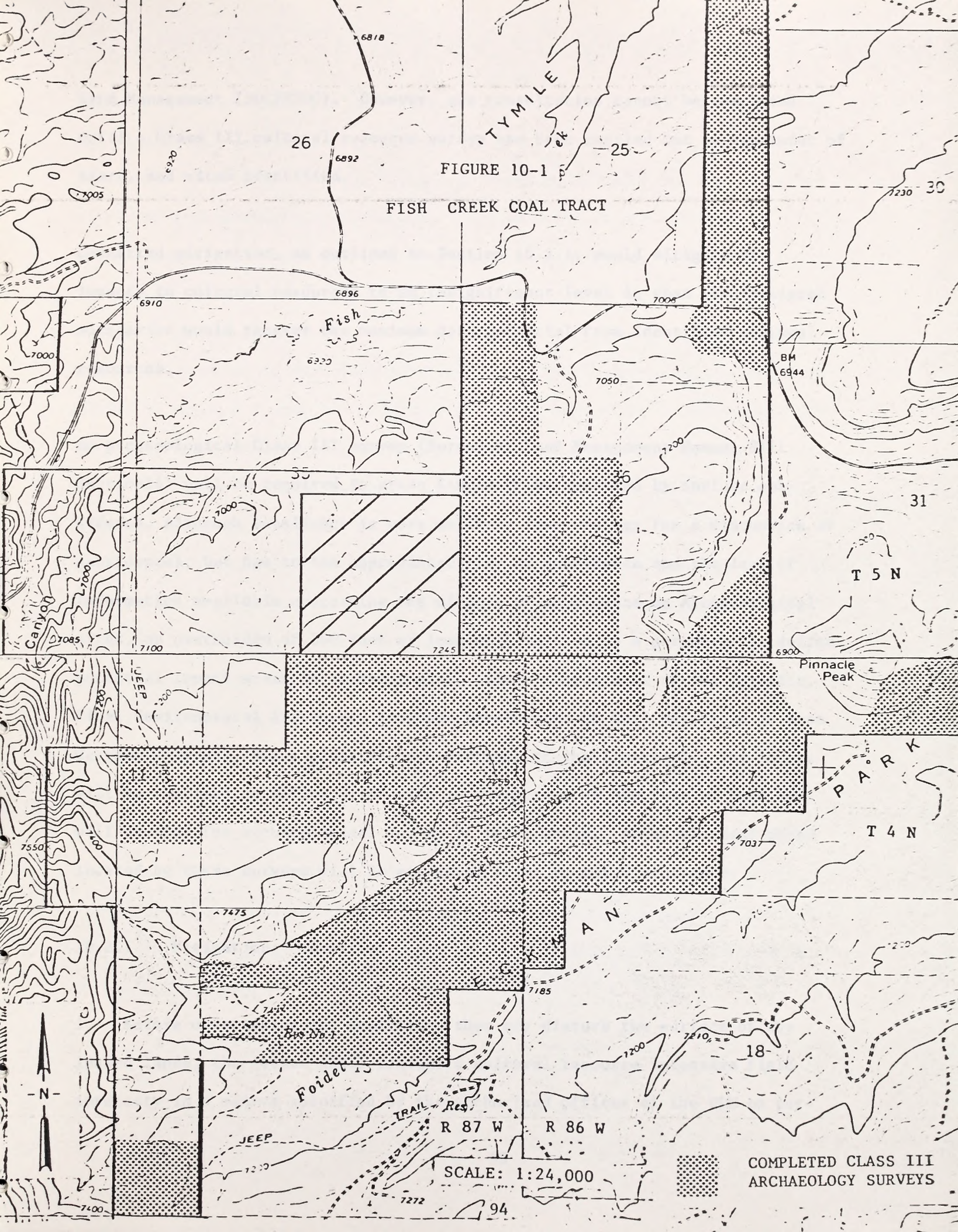
Presently within this coal tract there are three recorded cultural resources:

SRT 187	Isolated find "mano"
SRT 179	Homestead Late 19th/early 20th century
SRT 180	Rock pile/hunters blind Anglo/American 1905/1917

Consultation to determine significance and eligibility of the above sites to the National Register of Historic Places is currently being done for the above sites (36CFR800).

10.2 Environmental Consequences

Determination of a cultural resources significance is a process of consultation with the Colorado State Historic Preservation Officer (SHPO) and the Bureau of



Land Management (30CFR800). However, the consultation cannot be completed until a Class III cultural resource survey has been carried out on remainder of tract, and sites identified.

Committed mitigation, as outlined in Section 10.2.1, would mitigate the impacts to cultural resources to an insignificant level in that the committed mitigation would recover the maximum data potential from identified cultural resources.

An archaeological Class III survey (Bureau of Land Management Manual 8111 Section 14) will be required in areas likely to be impacted by surface subsidence. Although subsidence is very unlikely (see Geology for a discussion of subsidence), but due to the unpredictability of subsidence and the lack of information available concerning the effects of subsidence on Archaeological sites, an overburden of 300 feet or less will be used as a parameter to define potential impact areas to archaeological values (Department of the Interior, Final Environmental Statement, Proposed Development of Coal Resources in West Central Colorado, N.A.; prepared by Department of the Interior). The lessee will be required to define areas with an overburden of 300 feet or less and will provide for archaeological survey of these areas. Archaeological sites located by these surveys will be mitigated prior to any disturbance.

10.2.1 Mitigation: Committed

1. Before undertaking any activities that may disturb the surface of the leased lands, the lessee shall conduct a cultural resource intensive field inventory in a manner specified by the authorized officer of the BLM on por-

tions of the mine plan area and adjacent areas, or exploration plan area, that may be adversely affected by lease-related activities and which were not previously inventoried at such a level of intensity. The inventory shall be conducted by a qualified professional cultural resource specialist (i.e., archaeologist, historian or historical architect, as appropriate), approved by the authorized officer of the Bureau of Land Management, and a report of the inventory and recommendations for protecting any cultural resources identified shall be submitted to the Administrator of the Western Technical Center of the Office of Surface Mining (or the District Mining Supervisor if activities are associated with coal exploration outside an approved mining permit area) and the authorized officer of the BLM. The lessee shall undertake measures, in accordance with instructions from the Administrator of the Western Technical Center (or the District Mining Supervisor if activities are associated with coal exploration outside an approved mining permit area), to protect cultural resources on the leased land. The lessee shall not commence the surface-disturbing activities until permission to proceed is given by the Administrator of the Western Technical Center (or the District Mining Supervisor if activities are associated by coal exploration outside an approved mining permit area).

2. The lessee shall protect all known cultural resource properties within the lease area from lease-related activities until the cultural resource mitigation measures can be implemented as part of an approved mining and reclamation plan or exploration plan.

3. The cost of conducting inventories, preparing reports, and carrying out mitigation measures shall be borne by the lessee.

4. If cultural resources are discovered during operations under this lease, the lessee shall immediately bring them to the attention of the Administrator of the Western Technical Center (or the District Mining Supervisor if activities are associated with coal exploration outside an approved mining permit area), or the authorized officer of the surface-managing agency if the Administrator of the Western Technical Center, or District Mining Supervisor, as appropriate, is not available. The lessee shall not disturb such resources except as may be subsequently authorized by the Administrator of the Western Technical Center (or the District Mining Supervisor if activities are associated with coal exploration outside an approved mining permit area). Within two (2) working days of notification, the Administrator of the Western Technical Center (or the District Mining Supervisor if activities are associated with coal exploration outside an approved mining permit area) will examine or have examined any cultural resources discovered and will determine if any action may be required to protect or preserve such discoveries. The cost of data recovery for cultural resources discovered during lease operations shall be borne by the surface managing agency unless otherwise specified by the authorized officer of the BLM or of the surface managing agency (if different).

REFERENCES

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- Bureau of Land Management, 1978a. Report of Examination for Cultural Resources LSRA - Williams Fork P.V., T.4N., R.86W., Sec 18, 19, 13, 24, 25. By S. Hanson, Bureau of Land Management, Little Snake Resource Area. Craig, Colorado
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THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek Tract

State: Colorado

Leasing/Development Scenario: Surface Underground

Resource Element	Committed Mitigation	Anticipated			Impact		Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line	1992	1995	2000	EML			
Cultural Resources	Antiquities Act of 1906. Historic Sites Act of 1935. Historic Preservation Act of 1966 as amended. National Environmental Policy Act of 1969. Archaeological and Historic Date Conservation Act of 1974. Executive Order 11593. Procedures for the Protection of Historic and Cultural Resources (36CFR 800). Colorado Antiquities Act of 1973. Colorado Land Use Act of 1974. Archaeological Resources Protection Act of 1979.	1,577 acres surveyed	Unk	Unk	Unk	Unk	Fair to poor.	Loss of Cultural resources data through vandalism, unintentional damage, undetected sites being destroyed and mitigation efforts.	Class III survey be performed in subsidence areas and cultural resources mitigated.
								Loss of site data for surface and subsurface cultural resources in surface subsidence areas.	

11 Economics

11.1 Affected Environment

The impacted area consists of Routt County and includes the communities of Hayden, Milner, Oak Creek, Phippsburg, Steamboat Springs, and Yampa.

Routt County's economy is expected to show mixed trends in the 1990's, with continued tourist industry growth in the Steamboat Springs area, but a declining trend in the smaller communities as some of the older coal deposits become depleted. Overall, there will be some slack in the labor market, with surplus labor available for new jobs.

As a result, Steamboat Springs will be facing the need to expand its community facilities and services during the decade, while the other communities' capital improvement requirements should be small.

11.2 Environmental Consequences

11.2.1 Scenario 1: Extension of Existing Mine

Under the assumption stated in Section 6 of the Tract Profile Report, leasing the Fish Creek Tract would result only in maintaining the production and level of an existing surface mine, and subsequent conversion to an underground mine would occur regardless of this action. Therefore, there would be no economic impacts caused by the action.

11.2.2 Scenario 2: New Mine

Under this scenario, leasing the Fish Creek Tract would cause increases in the area's employment and population, but none of the increases would result in significant impacts to the communities. There would be moderately significant increases in the revenues of Routt County and Oak Creek.

At peak construction of the surface mine in 1992, the populations of Milner, Oak Creek, and Phippsburg would be increased about one percent, while the other three communities would grow by less than one-half percent. Full surface mine operation in 1995-1997 would cause negligible population impacts to any of the communities. Because of the slack labor market expected in the area, little or no immigration would be required during this phase. Construction of the underground mine portals, about 1996, would bring a small increase in construction-related population for a period of a few months, mostly in Oak Creek and Steamboat Springs. Full underground mine operation, beginning in 1998, would result in population growth ranging from five percent in Oak Creek to one percent in Steamboat Springs and Yampa.

Table 11-1 shows approximate employment gains expected in each community at the different stages of the development. It should be emphasized that, because many of these jobs would be filled by local residents, population increases would be small relative to the growth in jobs. Secondary employment is included in the figures.

This population growth might create some housing problems, particularly in Oak Creek, but they should not be severe.

Construction and operation of the surface mine would create annual wage and salary income of about \$2,300,000, while full underground mine operation would raise total area income about \$7,900,000.

Impacts to livestock grazing, farming, and hunting, the only present activities on the tract that affect the local economy, would be insignificant (see Land Use and Wildlife analyses).

The mine, after becoming an underground operation, would pay a total of \$2,700,000 in ad valorem and severance taxes and federal royalty. Of that amount, some \$600,000 would accrue or be returned to Routt County. Steamboat Springs would receive an additional \$110,000 annually in sales taxes induced by growth plus its severance tax share. Oak Creek would gain about \$50,000 per year and Hayden about \$20,000, but revenue benefits to Yampa would be small. The unincorporated communities of Milner and Phippsburg could receive no revenues.

TABLE 11-1

EMPLOYMENT GROWTH

	Peak Surface Mine Construction (1992)	Full Surface Mine Construction (1995-97)	Peak Underground Mine Construction (1996)	Full Underground Mine Construction (1998-EML)
Hayden	10	10	40	40
Milner	2	2	5	5
Oak Creek	25	30	100	110
Phippsburg	2	2	10	10
Steamboat Springs	25	30	100	110
Yampa	2	5	10	10

TABLE 11-7

REPLANT GROWTH

	Peak Replant Growth (1972)	Fall Replant Growth (1972-73)	Fall Replant Growth (1973)	Fall Replant Growth (1973-74)
Bay Area	10	10	40	40
Midwest	2	2	2	2
San Diego	25	30	100	110
Philadelphia	2	2	10	10
Newport Spang	25	30	100	110
Yampa	2	2	10	10

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: Scenario 2: New Mine

Comments
(Context)
(Proposed Mitigation)Irreversible &
Irretrievable
Data
Reliability
CommitmentsImpact
EML
Anticipated
Base Line 1992 1995 2000
(Percent of baseline)Resource
Element
Committed
Mitigation

Population:

Hayden	0	0	2				
Milner	1	0	2				
Oak Creek	Varies	1	0	5	NA		
Phippsburg	by year	1	0	3			Only construction materials.
Steamboat Springs	0	0	1				
Yampa	0	0	1				

Reasonable baseline projections cannot be made beyond the year 2000.

Employment

Routt County	None	Varies by year	1	1	2	NA	Medium	Only construction materials.
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Wage & Salary Income

Routt County	None	Varies by year	1	1	4	NA	Medium	Only construction materials.
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Operating Revenue

Routt County	None	Varies by year	0	8	6	NA	Medium	Only construction materials.
--------------	------	----------------	---	---	---	----	--------	------------------------------

Community Revenues

Hayden	0	1	4					
Milner	0	0	0					
Oak Creek	None	Varies by year	3	1	18	NA	Medium	None
Phippsburg			0	0	0			
Steamboat Springs			0	0	1			
Yampa			0	1	3			

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: Scenario 2: New Mine

Resource Element	Committed Mitigation	Anticipated Significant Impact			Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line	1992	1995 2000			
		(Percent of baseline)					
Operating Revenue Routt Conty	None	Varies by year	0	8	6	NA	Reasonable baseline projections cannot be made beyond the year 2000.
Community Revenues Oak Creek	None	Varies	3	1	18	NA	

12 Social

12.1 Affected Environment

Scenario 1: No communities would experience significant social impacts from this alternative.

Scenario 2: Two towns (Oak Creek and Phippsburg) would experience significant social impacts from leasing of this tract under these assumptions. Impacts on Steamboat Springs, Milner, Hayden, and Yampa would not be significant.

Oak Creek:

The population of Oak Creek (including Stagecoach) rose 89% (492 to 929) between 1970 and 1980, gaining slowly since. The economy is fairly diversified, its citizens working mostly in the coal mines, but also in the railroad yards in Phippsburg, the ski industry in Steamboat, the Hayden power plant, and in construction projects around the area.

In the early seventies a considerable Hippie subculture settled in Oak Creek, of which some remnants still remain. (The rest have "gone to work in the mines and now it is OK to wear a beard in the mines.") An unobtrusive "wealthy" class also lives in Oak Creek. Neither of these two groups participate much in the social life of the town.

Shopping, most social services, and "cultural" facilities in Oak Creek are limited. The whole upper Yampa Valley tends to depend on Steamboat or Craig

for these, though Oak Creek itself serves as a subcenter for Phippsburg and Yampa communities.

Oak Creek has an active school program which provides a social focus for the upper valley. Recreational facilities include a town park reasonably well-equipped, a community center with various services including day care and elderly programs, several bars, summer sports programs for adults and children, and a winter ski tow rope sponsored by the Lions Club. Oak Creek has two churches and at least 15 organizations serving social interests and needs of the population. No severe on-going social control problems appear to exist.

Because of soft coal markets and the approaching depletion of currently operating mines, Oak Creek in a few years may face something of a decline if no new mines are opened, though growth of the ski industry (especially Stagecoach) would bring spillover employment locally. Attitudes appear to favor continuation and growth of coal mining in the area.

Phippsburg:

This community has about 150 people with another hundred or so in the postal delivery area. It is unincorporated, but a "Phippsburg Community Club" composed of all persons in the community and nearby, and with elected officers, serves to integrate the entire population socially and is the decision-making entity for virtually all local affairs. "The Club" organizes and carries out many community-wide events such as Christmas festivities, and schedules pot-luck suppers at some regular meetings. It also plans for community needs such as street lighting and sewer lines, operates (with volunteers) a thrift shop

which produces profits to pay street light costs, etc. It sponsors a community center building housing a library and other facilities. Auxiliary women's groups contribute to running and supplying this center.

Many other evidences exist that Phippsburg retains, informality, and ethics of traditional rural America. Social cleavages take more the form of "extended family squabbles" than "intergroup conflicts."

Such a community is highly vulnerable to sudden growth, though culturally similar newcomers may gain acceptance quickly if they participate willingly. Transient workers would be unusually difficult to integrate socially, especially if they were young unattached males.

Shopping and other services are available only in Oak Creek, Steamboat Springs, or Craig. Some major shopping is done in Denver.

The presence of coal miners in the community would give Phippsburg some precedent for social integration of new mine workers, but rapid growth would be very hard on this small community.

12.2 Environmental Consequences

Scenario 1: No communities would experience social impacts from this scenario.

Scenario 2:

Social impacts from this tract scenario, except for Steamboat Springs, would be on a stable or slightly declining baseline. In all cases the principal impacts would occur within the single year, 1995-1996, when operations would be expected to go from surface to underground mining. No significant proportion of new employment would be transient construction workers because of the gradual nature of the shift to underground. Growth figures shown are in addition to the local unemployed pool which would be used up.

Table 12-1, showing all socially affected communities, gives first the 1995-96 baseline and tract-related changes. Column E is the percent change due to tract population impact. Oak Creek would grow moderately (4.5%) from the tract alone, and Phippsburg would grow by 2.5%, by itself a rate of negligible social significance. No other communities would be affected significantly at all by growth rate alone.

Figure 12-1 shows the predicted population baseline and tract growth estimates for Oak Creek and Phippsburg from 1990-1998, indicating the 1995-96 growth spurts. A much smaller absolute number becomes significant for Phippsburg because of its initial small population.

Severity of impacts can be lessened or exacerbated by factors other than mere growth rate. Table 12-1 also shows what is likely to happen to the six communities taking into account social readiness (discussed in Section 12.1) for each community. Except for Oak Creek and Phippsburg, again, all impacts would be insignificant.

Phippsburg, because its highly cohesive but largely informal relational structure makes for an unusually tight set of social boundaries, might have considerable trouble absorbing sudden growth. Where the absolute numbers are so small, the actual degree to which social impacts are negative would depend largely upon characteristics of the specific in-migrating persons and how willing they proved to be to "fit into" a restrictive social frame. The formal social structure itself would not change much because predicted additions would not begin to bring about the formalization needed by a community of Oak Creek's size or greater.

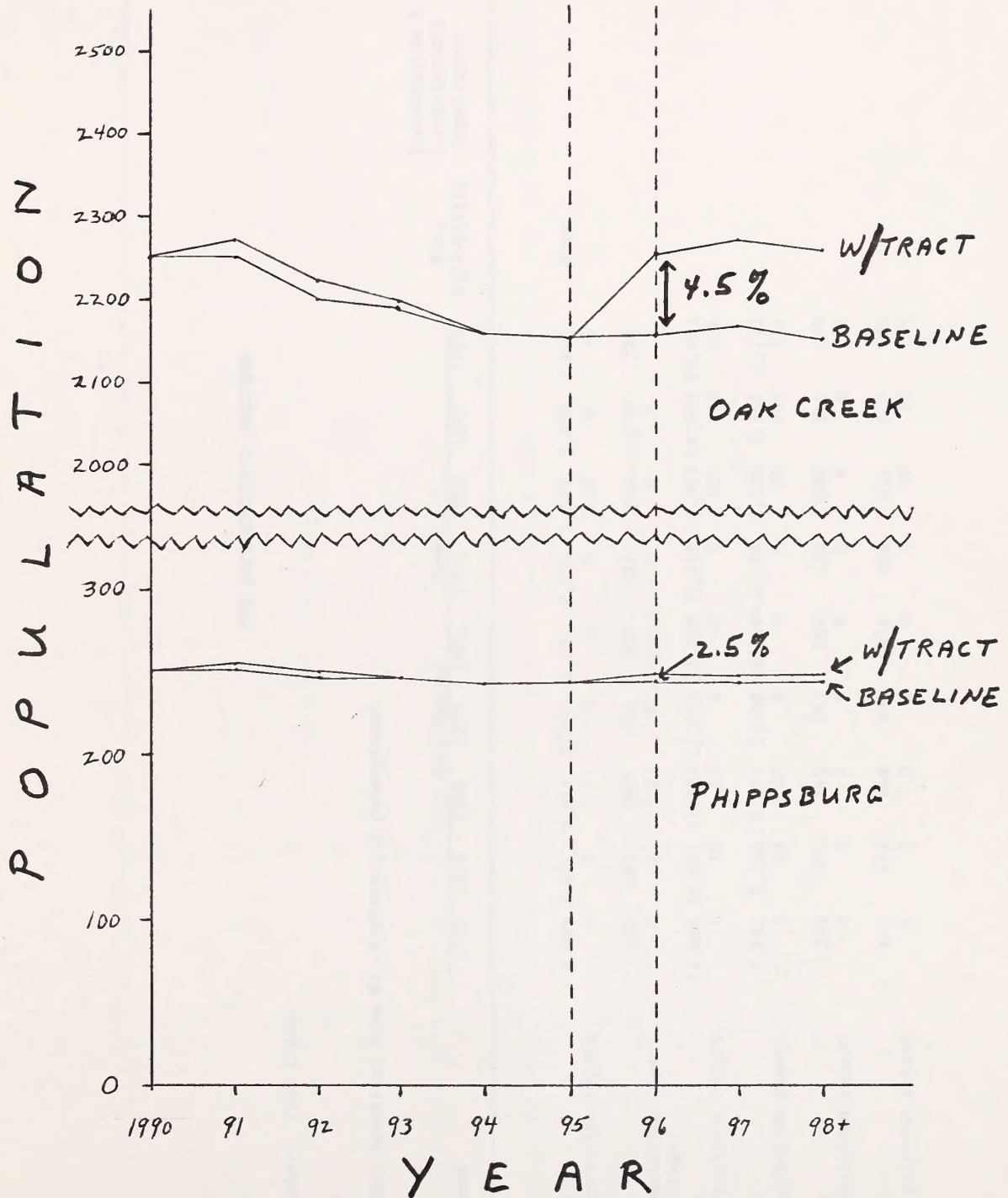
Oak Creek is heavily dependent on coal mining. Because the incoming workers would be mostly permanent and could be predicted at least a few years in advance, the potential severity could be largely alleviated by advance effort. The impacts would also be lessened by Oak Creek's present cultural orientation to coal miners and mining.

TABLE 12-1
Severity of Social Impacts from Fish Creek Tract (Scenario 2), 1995-1996
Based on Population Growth Rate and Readiness

Community	A Baseline 1995	B 1996 Population	C Change (No.)	D Tract-Related Increase		E Population 1995-1996 % Change	F Social Readiness Level	G Significance of Social Impact from Tract	H Not Effect of Tract-Related Population (C+D)	I Effect of Tract-Related Population (H+B)
				No.	(1995-1996)					
Hayden	2,705	2,679	- 26	+ 36		1.3	High	Insignificant	+ 10	.4%
Milner	227	231	+ 4	+ 4		1.7	Moderate	Insignificant	+ 8	3.5%
Steamboat Springs	12,159	12,380	+221	+109		1.0	High	Insignificant	+330	2.7%
Oak Creek	2,154	2,159	+ 5	+ 98		4.5	High	Low	+103	4.8%
Phippsburg	239	240	+ 1	+ 6		2.5	Low	Low	+ 7	2.9%
Yampa Division	920	911	- 9	+ 10		1.1	Low	Significant	+ 1	.1%

FIGURE 12-1

Fish Creek Scenario 2: Tract-Related Population Growth
(With Baselines), 1990-1988, Oak Creek and Phippsburg.



THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: Mine #2 Surface and Underground

Resource Element	Anticipated							Impact	Data Reliability	Irreversible & Irrecoverable Commitments	Comments (Context) (Proposed Mitigation)
	1990	1991	1992	1993	1994	1995	1996	1997	1998		
Social:											
Hayden:											
Baseline	2,889	2,879	2,811	2,760	2,734	2,705	2,679	2,670	2,618		
Total Population Impact	2	7	7	2	0	0	36	40	41		Poor
Milner:											
Baseline	218	221	220	222	225	227	231	235	236		
Total Population Impact	0	2	2	0	0	0	4	4	5		
Steamboat Springs:											
Baseline	11,686	11,866	11,827	11,915	12,050	12,159	12,380	12,589	12,683		
Total Population Impact	1	15	15	4	0	0	109	119	124		
Oak Creek:											
Baseline	2,255	2,258	2,201	2,188	2,163	2,154	2,159	2,166	2,153		
Total Population Impact	3	18	20	8	0	0	98	107	111		
Phippsburg:											
Baseline	250	251	245	243	240	239	240	241	239		
Total Population Impact	0	3	3	0	0	0	6	6	7		
Yampa:											
Baseline	987	978	949	950	936	920	911	902	904		
Total Population Impact	0	3	3	0	0	0	10	10	11		

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: Mine #2 Surface and Underground

Resource Element	Committed Mitigation	Anticipated Significant Impact				Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line	1992	1995	2000			
					EML			
<u>1995 - 1996</u>								
Social:								
Oak Creek	None					Poor		
Baseline		2,154	2,159		4.5% with			
Total Pop. Impact		98			High Social	Low significance		
Percent of growth		4.5%			Readiness			
Phippsburg								
Baseline	None	239	240		2.5% with			
Total Pop. Impact		6			Low Social	Low significance		
Percent of growth		2.5%			Readiness			

13 Land Use

13.1 Affected Environment

13.1.1 Agriculture

There are a number of grazing operators with portions of lease areas in the tract. The table below displays the grazing information on these operations.

Grazing Operator	Livestock Class	Season of Use	AUMS (Animal Unit Months)				Estimated Total on And Off Tract
			Fed.	Priv.	State	Total on Tract	
Colo. Yampa Coal Co.	--	Summer	0	50	0	50	N/A
Robert Perry	Cattle	Summer	0	231	0	231	Unknown
Robert Adams	Cattle	Summer	0	141	0	141	10,000
Bogle Farms	Sheep/ Cattle	Summer	0	201	0	201	29,400
Papoulas	Sheep	Summer	0	142	0	142	10,000

There is a total of 765 AUM's available from the tract.

13.1.2 Dwellings

There is one permanent residence located on the tract and several unoccupied buildings. The permanent residence is located in Section 36, NE $\frac{1}{4}$ NW $\frac{1}{4}$ (Map 2).

13.1.3 Rights-of-Ways

There are no major rights-of-ways on tract. Any minor rights-of-ways on tract could be moved or mitigated between the lessee and the R-O-W holder. The only known minor R-O-W on tract is County Road 27 which has been relocated for mining in the past. This relocation is not shown on the map and disturbance from development does not affect the location of County Road 27.

13.1.4 Withdrawal

There are no known withdrawals on this tract.

13.2 Environmental Consequences

13.2.1 Agriculture

R. Adams would temporarily lose 141 AUM's, which is only 1% of his entire operation, and is therefore not significant. Bogle Farms would temporarily lose 201 AUM's, which is less than 1% of the entire ranch operation, and therefore not significant. Papoulas would temporarily lose 142 AUM's, which is 1% of the entire ranch operation, and is therefore not significant. Colorado Yampa Coal would lose 50 AUM's, which is considered insignificant since it is a coal company and expressed interest in mining the tract. Robert Perry would lose 231 AUM's, but the significance of this loss to his entire operation is not known. There is 527.25 acres on the tract planted to wheat. The disturbance would cause the loss of 153.0 acres and 171 acres of wheat production in Scenarios 1 and 2. This is not a significant loss to the farming operations.

13.2.2 Rights of Ways

The minor rights-of-ways would be protected by incorporating the following stipulation: This lease is subject to all valid rights existing on date issued. This stipulation should not preclude the development of coal because it is assumed that any minor rights-of-way can be moved or mitigated.

13.2.3 Dwellings

The owner of the residence is not a qualified surface owner. If either leasee, Colorado Yampa Coal (Scenario 1) or a new operator (Scenario 2), does not purchase the residence, then the regulations would protect the resident. This would preclude the development of approximately 150,000 tons of surface mineable coal and exclude 10 acres of surface area. The residence would not affect the development of subsurface coal as sufficient overburden (approximately 1,000') would curtail any impacts.

13.2.4 Short Term vs. Long Term Productivity

The temporary loss of 765 AUM's is not a significant loss to long-term productivity, due to post mining reclamation regulations.

13.2.5 Irreversible/Irretrievable

None.

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1 and 2

Resource Element	Committed Mitigation	Anticipated Impact			Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line	1992	1995	2000	EML	

Land Use:

Agriculture:

a. Grazing

AUMs
765

765 765 765 765 Fair

Since the entire tract is unavailable to livestock during the life of the mine, both scenario 1 and 2 are not significant.

b. Wheat

Acres
527.25

0 153 153 153 Fair

Insignificant impact.

Scenario 2: 527.25

56.43 171 171 171

Dwellings

There is one residence located within the boundary of the tract.

Rights of Ways

Minor ROW

0 0 0 0

See narrative

Withdrawal

None

None None None None

14 Transportation

14.1 Affected Environment

14.1.1 Highway Transportation

The affected transportation routes are Routt County road 27, U.S. Highway 40, and Colorado State Highway 131. Routt County road 27 is a paved, two lane road winding through the backcountry between U.S. Highway 40 east of Hayden and Colorado State Highway 131 at Oak Creek. This is the main access route which runs through the tract. There is no traffic data for any county road. Traffic on county road 27 is assumed to be heavy due to existing mine and local traffic.

U.S. Highway 40 and Colorado State Highway 131 provide access for mine employees living in Craig, Hayden, Steamboat Springs and other areas.

Table 14-1 gives the projected Average Daily Traffic (ADT) for U.S. Highway 40 between Craig and Hayden (Segment B) and between Hayden and Steamboat Springs (Segment C). ADT is also projected for Colorado State Highway 131 between Steamboat Springs and Oak Creek (Segment L) and between Oak Creek and Tampa (Segment M). The table also gives the design hour volume (DHV) which is the 30th highest hourly volume occurring in a year. DHV is multiplied by ADT to project peak hour traffic (PHT) given in Table 14-2. Any projections past the year 2000 are inaccurate.

TABLE 14-1

PROJECTED AVERAGE DAILY TRAFFIC FOR U.S. HIGHWAY 40
AND STATE HIGHWAY 131

Road Segment	Segment Length	Average Daily Traffic					DHV
		1985	1992	1995	2000	EML	
B	14.8	3900	4600	4900	5400	7000	.12
C	23.4	4400	5150	5500	6100	9500	.12
L	16.7	1400	1650	1750	1900	3300	.20
M	9.4	1300	1550	1700	1900	3250	.20

Table 14-2 gives the volume to capacity ratios (%) for the peak hour traffic through EML. This ratio, between PHT and the highway capacity, indicates traffic conditions on the highway during high use periods. Any coefficient greater than 1.0 will indicate that significant congestion will occur resulting in time delays and increased safety risks. A coefficient of 0.8-1.0 will indicate a high probability for at least momentary or minor road congestion. A coefficient of 0.8 or below will indicate that the road segment has adequate capacity to handle the projected traffic. The level of service for State Highway 131 is expected to remain constant through the next 20 years. However, the level of service for U.S. Highway 40 is expected to be lowered beginning in 1992 and lowered further as it approaches capacity. Improvements would be required to raise the capacity level of the highway.

TABLE 14-2

PROJECTED VOLUME/CAPACITY RATIO - U.S. HIGHWAY 40
AND STATE HIGHWAY 131

Road Seg.	Peak Hour Traffic					Capacity Volume @ Service Level "C"	Volume/Capacity Ratio				
	1985	1992	1995	2000	EML		1985	1992	1995	2000	EML
B	468	552	588	648	840	680	.69	.81	.86	.95	1.24
C	528	618	660	732	1140	680	.78	.91	.97	1.08	1.68
L	280	330	350	380	660	620	.45	.53	.56	.61	1.06
M	260	310	340	380	650	750	.35	.41	.45	.51	.87

Table 14-3 indicates the total number of accidents projected for the road segments. By determining the vehicle miles travelled per year, times the accident rate divided by one million, the total number of accidents per year can be projected. The same methodology is used to project the number of fatal accidents per year, except the product is divided by 100 million instead of one million. The methodology assumes that no significant increase in the accident rates will occur.

TABLE 14-3

PROJECTED ACCIDENTS FOR U.S. HIGHWAY 40 AND STATE HIGHWAY 131

Road Seg.	Seg. Lgth	Average Daily Traffic					Total Accident Rate (1980)	Total Accidents				
		1985	1992	1995	2000	EML		1985	1992	1995	2000	EML
B	14.8	3900	4600	4900	5400	7000	2.88	61	72	76	84	109
C	23.4	4400	5150	5500	6080	9500	2.53	95	111	119	131	205
L	16.7	1400	1650	1750	1900	3300	5.02	43	50	54	58	101
M	9.4	1300	1550	1700	1900	3250	15.42	69	82	90	101	172

14.1.2. DRGW Railroad

The Denver and Rio Grande Western Railroad has a main line running from Denver through the Moffat Tunnel terminating in Craig. A 12-mile spur line runs from Milner to the Colorado Yampa mine east of the tract. Currently the rail line between Craig and Bond has approximately eight (8) unit trains per day passing over the tracks while the segment from Bond to Denver has twenty (20) unit trains per day. The present control system is an automatic block system. One at-grade highway crossing would be affected along this route. Traffic delays at each crossing are currently less than 15 minutes a day. Table 14-4 lists Colorado crossing I.D. number, approximate location, and existing hazard rating through 1996.

Two at grade crossings at intersections with county roads on the spur line would be affected. There is no data for traffic or hazard rating for these crossings.

TABLE 14-4
EXISTING RAILROAD CROSSING HAZARD RATINGS

Colorado Crossing I.D. Number	Location	Hazard Rating (Accidents per Five Years)	Hazard Rating 1996
0134-28-05	East of Toponas	.15	.66

Source: Colorado Department of Highways

14.2 Environmental Consequences

14.2.1 Highway Transportation

Scenario 1

There would be no change in the existing transportation; thus, no significant impact. However, any impact associated with the existing mine would be extended.

Scenario 2

Table 14-5 gives the increase in ADT as a result of the new mine. Table 14-6 gives the increased volume to capacity ratios using the same methodology as explained in Section 14.1. The increase in traffic would have an insignificant effect on the state highway sections which have enough excess capacity to absorb the project's work vehicles without lowering the service level. The level of service for U.S. Highway 40 would be lowered without the project and without improvements. Therefore, no significant impact would occur as a result of the project.

Table 14-7 indicates that the number of increased traffic accidents resulting from the proposed mine is low to moderate.

Routt County road 27 would be the main access and coal haul route from the mine to the loadout facilities. Employee and coal truck traffic would increase ADT by approximately 700 by the year 2000. This increase in traffic would probably

result in slowdowns and congestion during peak hour traffic as well as an increase in accidents. However, no analysis has been done due to lack of traffic data for county roads and the impacts are insignificant.

Other impacts associated with the project's transportation needs would be wildlife disturbance (see Wildlife), increased exhaust emissions, increased noise (see Noise), increased maintenance costs by the leasee and increased accidents.

TABLE 14-5

INCREASED AVERAGE DAILY TRAFFIC - U.S. HIGHWAY 40
AND STATE HIGHWAY 131

Road Segment	Average Daily Traffic					Increase in Peak Hour Traffic				
	1985	1992	1995	2000	EML	1985	1992	1995	2000	EML
B	0	0	4950	5500	0	0	0	25	50	0
C	0	0	5550	6200	0	0	0	10	30	0
L	0	1700	1800	2150	0	0	30	30	125	0
M	0	0	0	1950	0	0	10	10	25	0

TABLE 14-6

INCREASED VOLUME/CAPACITY RATIO - U.S. HIGHWAY 40
AND STATE HIGHWAY 131

Road Segment	Increased Peak Hour Traffic					Capacity (Volume @ Service Level "C")	Volume/Capacity Ratio				
	1985	1992	1995	2000	EML		1985	1992	1995	2000	EML
B	0	0	613	698	0	680	0	0	.90	1.03	0
C	0	0	670	762	0	680	0	0	.98	1.12	0
L	0	360	380	505	0	620	0	.58	.61	.81	0
M	0	320	340	405	0	750	0	.43	.45	.54	0

TABLE 14-7

INCREASED ACCIDENTS FOR U.S. HIGHWAY 40
AND STATE HIGHWAY 131

Road Segment	Segment Length	Increase In Average Daily Traffic				Total Accident Rate (1980)	Increase in Accidents			
		1985	1992	1995	2000		1985	1992	1995	2000
B	14.8	0	0	50	100	2.88	0	0	1	2
C	23.4	0	0	50	100	2.53	0	0	1	2
L	16.7	0	50	50	250	5.02	0	2	2	8
M	9.4	0	0	0	50	15.42	0	0	0	3

14.2.1 DRGW Railroad

The project would add less than one unit train per day. One unit train would carry approximately 7,500 tons of coal. Approximately one half unit train per day will have the 3,600 tons of coal produced a day while the other half would return to the loadout. The limiting factor for the rail line's capacity is anticipated to be rolling stock and power equipment, not the rail's carrying capacity. The addition of one unit train per day would increase the grade crossing's hazard rating. There would be no significant impact.

14.2.3 Unavoidable Adverse Impacts

Adverse environmental impacts on the transportation system which cannot be avoided are: increased traffic accidents, increased grade crossing hazard ratings, increased capital expenditures for road maintenance, and increased noise.

14.24 Short Term vs. Long Term

Impacts to the transportation system would be short term, lasting throughout the life of the mine. The impacts are insignificant.

14.2.5 Irreversible/Irretrievable Commitments

The materials used for building or improving the access roads as well as maintenance of all affected roads would be irretrievably committed by the leasee, which is insignificant. Loss of life and property in transportation-related accidents would be irretrievably committed.

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1

Resource Element	Committed Mitigation	Anticipated			Impact EML	Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line	1992	1995	2000			
Transportation				No significant impact		Good		No change in transportation. Any impacts associated with existing project would be extended.

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 2

Resource Element	Committed Mitigation	Anticipated				Impact EML	Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line	1992	1995	2000				
<u>Transportation</u>									
		<u>Increased Volume/Capacity Ratio</u>							
U.S. Hwy. 40		0	0	.90	1.03	0	Good	Materials used for roads or improve-	Level of service for U.S. Highway 40 is lowered without the project thus no significant impact. Level of service for State Highway 131 would remain constant with the addition of employee traffic.
Segment B		0	0	.98	1.12	0		ments as well as	
Segment C								maintenance would	
State Hwy. 131		0	.53	.61	.81	0		be irretrievably	
Segment L		0	.43	.45	.54	0		committed which	
Segment M								is insignificant.	
		<u>Increased ADT</u>							
Routt County Road 27		0	100	450	700	0	No existing traffic data for county roads.	Loss of life and property in transportation accidents would be irretrievably committed.	Increase in ADT to county road 27 due to coal truck and employee traffic. No significant impact.

U.S. Highway 40
Segment B
Segment C
State Highway 131
Segment L
Segment M

		<u>Increase in Accidents</u>			Good
		0	1	2	
0	0	0	1	2	0
0	0	0	1	2	0
0	2	2	8		0
0	0	0	3		0
<u>Increase in Train Movements</u>					
0	0	1	train/day	0	

DRGW Railroad

Grade crossing hazard rating would increase. No significant impact.

15 Noise

15.1 Affected Environment

15.1.1 Noise on Tract

The existing noise environment consists of sounds from two environments-- background noise from surface mining adjacent to the tract and traffic noise on Routt County Road 27. Noise levels are estimated to be 35 to 55 dB. A noise level of 50 dB is considered the threshold for uncomfortable noise for humans.

15.1.2 Transportation Noise

Table 15-1 shows the projected noise levels for the affected transportation routes. See Transportation, Section 14.1, for explanation of road segments.

TABLE 15-1
PROJECTED NOISE LEVELS FOR AFFECTED ROADS

Road Segment	Leq @ 100' (dB)				
	1985	1992	1995	2000	EML
B	68	69	69	70	71
C	69	70	70	70	73
L	65	66	67	67	69
M	65	66	67	67	69

Routt County Road 27 is assumed to have heavy traffic associated with coal mining causing high noise levels along this route.

Trains at the rate of 8 per day over the DRGW main line currently produce a noise level of 82 Leq (dBA) at 100 feet.

15.2 Environmental Consequences

15.2.1 Noise on Tract

Scenario 1 and 2

Surface mining will raise noise levels on tract by 23-24 dB. This increase would affect primarily wildlife and one residence on tract. The affect to the residence would depend on the leasee buying the property or the regulations protecting the residence. This impact is assumed to be insignificant.

Subsurface mining will raise noise levels on tract by 5 to 11 dB. Affect would be to the same receptors as listed for the surface mine and the impact assumed insignificant.

Noise from a typical surface mine produces a noise level of approximately 78 Leq (dB) at 500 feet. An underground mine produces a noise level of approximately 60-66 Leq (dB) at 500 feet.

15.2.2 Transportation Noise

Scenario 1

There would be no change to transportation and no significant impact. However, any impacts associated with existing mine would be extended.

Scenario 2

The noise environment along the affected transportation routes would change. Table 15-2 shows the estimated increase in traffic noise.

TABLE 15-2
INCREASE IN TRAFFIC NOISE AS A RESULT OF THE NEW MINE

Road Segment	Increase in Leq @ 100' (dB)				EML
	1985	1992	1995	2000	
B	0	0	1	1	0
C	0	0	1	1	0
L	0	1	1	1	0
M	0	1	1	1	0

An increase of 3 dB or more is considered a significant increase in noise. The increase in noise along the affected highways is considered to be insignificant as shown in Table 15-2.

A large increase in traffic would be expected for Routt County Road 27. Employee and coal truck traffic would increase noise levels along this route. No traffic data or estimate of existing noise levels is available so no estimate of the increase can be made. Increases in noise along this route would affect several residences and wildlife.

Adding one train per day to the existing main line, train traffic would increase noise by 1 Leq (dBA) @ 100 feet which is considered insignificant.

THE SITE SPECIFIC ANALYSIS

Tract Name or Number: Fish Creek

State: Colorado

Leasing/Development Scenario: 1 and 2

Resource Element	Committed Mitigation	Anticipated		Impact	EML	Data Reliability	Irreversible & Irretrievable Commitments	Comments (Context) (Proposed Mitigation)
		Base Line	1992		2000			

Noise Sources

Natural background from coal mining and traffic	Natural and Construction	Mine activities and traffic	Natural	Fair
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Increase in Leq @ 500'

Levels on tract	0	23-43 dB	20-40 dB	11-31 dB	0	Fair
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Would affect primarily wildlife on tract and one residence. Assumed to be insignificant impact.

Increase in Leq @ 100'

Transportation Levels - Scenario 1	0	0	0	0	0	Fair
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Increase is under 3 dB. No significant impact.

U.S. 40

Segment B

Segment C

State Highway 131

Segment L

Segment M

DRGW Railroad

Impacts to general population

Increase on County Road 27 would affect residences and wildlife.

No existing traffic data.

None

Health and Safety Standards

MSHA Regulations

Impacts to workers in high noise environment are mitigated.

None

No significant impact.

16 Net Energy Analysis

Scenario 1

Energy Inputs	Amount per Year (in BTUs)		Mine Life	
	Surface	Underground	Surface (1 yr)	Underground (18.5 yrs)
1. Mining Operation	5.33×10^{11}	4.92×10^{11}	Same as Column 1	9.10×10^{12}
2. Product Transportation	2.35×10^{12}	2.35×10^{12}		4.35×10^{13}
3. Employee Transportation	2.60×10^{10}	2.60×10^{10}		4.81×10^{11}
4. Infrastructure Support	1.27×10^8	1.27×10^8		2.35×10^9
5. Total	2.91×10^{12}	2.87×10^{12}		5.31×10^{13}
Energy Outputs	7.25×10^{13}	7.25×10^{13}		1.34×10^{15}
Ratio (output:input)	24.91:1	25.26:1		25.24:1

Calculations

- (1) Annual production x BTUs expended/ton
Surface = $3,300,000 \times 1.614 \times 10^5 = 5.33 \times 10^{11}$
Underground = $3,300,000 \times 1.49 \times 10^5 = 4.92 \times 10^{11}$

(2) Truck

Annual production x 1 way haul loaded x BTUs
Annual production x 1 way haul unloaded x BTUs

Train

Annual production x 1 way haul loaded x BTUs
Annual production x 1 way haul unloaded x BTUs

$$\begin{aligned}
3,300,000 \times 4 \times 1900 &= 2.51 \times 10^{10} \\
3,300,000 \times 4 &= 1.32 \times 10^7 \\
3,300,000 \times 1000 \times 392 &= 1.29 \times 10^{12} \\
3,300,000 \times 1000 \times 311 &= 1.03 \times 10^{12}
\end{aligned}$$

$$\text{Total} = 2.35 \times 10^{12}$$

- (3) # total employees x # miles to work x 2 x 6,250 BTUs x working days/year
 $150 \times 35 \times 2 \times 6250 \times 260 = 1.71 \times 10^9$
 $137 \times 20 \times 2 \times 6250 \times 260 = 8.91 \times 10^9$

$$\text{Total} = 2.60 \times 10^{10}$$

- (4) # people as result of project x 17,465 x 365
 $20 \times 17,465 \times 365 = 1.27 \times 10^8$

Energy outputs = annual production x coal quality (BTUs/ton)
(quality = 10,990 BTUs/lb)
 $3,300,000 \times 21,980,000 = 7.25 \times 10^{13}$

Ratio = output divided by input
Surface $(7.25 \times 10^{13}) : (2.91 \times 10^{12}) = 24.91:1$
Underground $(7.25 \times 10^{13}) : (2.87 \times 10^{12}) = 25.26:1$

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16 Net Energy Analysis

Scenario 2

Energy Inputs	Amount per Year (in BTUs)		Mine Life	
	Surface	Underground	Surface (3 yr)	Underground (62 yrs)
1. Mining Operation	1.61×10^{11}	1.49×10^{11}	4.83×10^{11}	9.10×10^{12}
2. Product Transportation	7.11×10^{11}	7.11×10^{11}	2.13×10^{12}	4.41×10^{13}
3. Employee Transportation	1.98×10^{10}	6.09×10^{10}	5.94×10^{10}	3.78×10^{12}
4. Infrastructure Support	2.89×10^9	9.89×10^9	8.67×10^9	6.13×10^{11}
5. Total	8.95×10^{11}	9.31×10^{11}	2.69×10^{12}	5.77×10^{13}
Energy Outputs	2.20×10^{13}	2.20×10^{13}	6.60×10^{13}	1.36×10^{15}
Ratio (output:input)	24.58:1	23.63:1	24.54:1	23.57:1

Calculations

- (1) Annual production x BTUs expended/ton
 Surface = $1,000,000 \times 1.614 \times 10^5 = 1.61 \times 10^{11}$
 Underground = $1,000,000 \times 1.49 \times 10^5 = 1.49 \times 10^{11}$

(2) Truck

Annual production x 1 way haul loaded x BTUs
 Annual production x 1 way haul unloaded x BTUs

Train

Annual production x 1 way haul loaded x BTUs
 Annual production x 1 way haul unloaded x BTUs

$$\begin{aligned} 1,000,000 \times 4 \times 1900 &= 7.60 \times 10^9 \\ 1,000,000 \times 4 &= 4.00 \times 10^6 \\ 1,000,000 \times 1000 \times 392 &= 3.92 \times 10^{11} \\ 1,000,000 \times 1000 \times 311 &= 3.11 \times 10^{11} \end{aligned}$$

$$\text{Total} = 7.11 \times 10^{11}$$

- (3) # total employees x # miles to work x 2 x 6,250 BTUs x working days/year
 Surface: $200 \times 20 \times 2 \times 6250 \times 260 = 1.3 \times 10^9$
 $60 \times 35 \times 2 \times 6250 \times 260 = 6.83 \times 10^9$

$$\text{Total} = 1.98 \times 10^{10}$$

$$\text{Underground: } 750 \times 25 \times 2 \times 6250 \times 260 = 6.09 \times 10^{10}$$

- (4) # people as result of project x 17,465 x 365
 Surface: $453 \times 17,465 \times 365 = 2.89 \times 10^9$
 Underground: $1551 \times 17,465 \times 365 = 9.89 \times 10^9$

Energy outputs = annual production x coal quality (BTUs/ton)
 (quality = 10,990 BTUs/lb)
 $1,000,000 \times 21,980,000 = 2.20 \times 10^{13}$

Ratio = output divided by input
 Surface $(2.20 \times 10^{13}) : (8.95 \times 10^{11}) = 24.58:1$
 Underground $(2.20 \times 10^{13}) : (9.31 \times 10^{11}) = 23.63:1$

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